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"PULPY KIDNEY" DISEASE OF LAMBS.

INVESTIGATION IN CENTRAL OTAGO, SEASON 1926.

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FOR many years, throughout New Zealand where the fat-lamb industry is carried on, sudden deaths have occurred among lambs at the age of about three to four weeks. Post-mortem examinations of the carcases have shown a pulpy condition of the kidneys and an excessive quantity of fluid in the heart sac. The lambs which died and showed these lesions were always exceptionally forward for their age, and almost invariably single lambs. Gilruth first investigated the disease, and after much careful work concluded that the trouble was of dietetic origin. The views he formulated are still held to-day—namely, that the condition is the result of the lambs being "done" too well, and that losses may be checked by such means as exercise, reduced diet, and blood-letting, these methods having proved highly effective in many instances.

In Central Otago the mortality among fat lambs of the age stated has increased very considerably within the past four or five years. In considering the general circumstances in which this has occurred, two outstanding facts must be borne in mind: (1) Within the last ten years, and more especially in the last five years, there has been a gradual increase in the use of Romneys—a breed which thrives and fattens exceedingly well in that district; (2) rabbits, which were present in vast numbers a few years ago, are now comparatively scarce, so that, generally speaking, the carrying-capacity of the land has been much increased, whereas in many cases the stock actually carried has not been increased proportionately.

In view of the heavier losses occurring there, the sheep-farmers of Central Otago approached the Department of Agriculture with a request that special investigation into the matter be carried out in their district, and since it was realized that much was still unknown regarding the actual bodily changes culminating in death, and as there was the possibility that more detailed inquiry into the matter might bring to light further points regarding prevention, the request was readily granted.

General Scheme of the Investigation.

After careful consideration the following plans were decided upon :—

Four suitable farms were to be selected—two on which losses from the disease in question habitually occurred, and two on which this was not the case. Analyses were to be made of the soil and pasture of these farms, and of milk-samples from ewes with twins and ewes with single lambs. Milk for analysis was also to be obtained from ewes whose lambs had died of the disease, if this were possible, and additional soil, pasture, and milk samples as the circumstances suggested. (This part of the plan was carried out as arranged, and the analyses made by the Department's Chemist and his staff, together with Mr. Aston's remarks regarding the results and on the subject generally, are presented in an accompanying article.)

Post-mortem examinations were to be made as thoroughly as possible, and materials to be collected for bacteriological and pathological examination. Further, all circumstances connected with the occurrence of the disease were to be carefully noted.

Since the state of the kidney is the most pronounced lesion found, it was considered necessary to take samples of blood at intervals from selected ewes and lambs on the four farms, so as to discover by biochemical methods if there existed any damming back of waste products in the blood as a result of inadequate functioning on the part of the kidneys.

It was felt, moreover, that while there could be no doubt that the disease was responsible for considerable losses, there were probably other causes for some of the deaths, and that possibly this accounted for the seeming failure in some cases of the preventive measures advocated.

The investigation was commenced in Maniototo County, with headquarters at Ranfurly, on the 14th October, 1926, at which date few losses had occurred, though elsewhere—Oamaru, for example—where the season is a little earlier, there had already been a heavy mortality.

Seasonal Occurrence of the Disease.

In Maniototo during the investigation the period when losses were greatest was from about the 20th October to the 8th November. Deaths occurred for some days prior to this period and gradually increased, then fell off rapidly in the early days of November. It has been the experience of all who were questioned that the same sort of thing happens annually, the losses always occurring about this time—a little earlier or later according as the season is a forward or backward one. In *rare* cases deaths occur in older lambs — from four to five months—and at other times of the year. A case of this sort has occurred recently, the post-mortem findings being typical of the disease in question.

Type of Lamb affected.

Sex : Personal observation, and reports from farmers who were good enough to keep notes of such things, show that, taken over large numbers, the sexes are about equally liable prior to marking, whereas among lambs dying after marking ewes are in the majority.

Breed : Romneys, Corriedales, and crosses of these two breeds seem to be most liable in the district under consideration, but this is probably

not significant, since the great majority of sheep in the district can be grouped under these headings. The following experience of a Kyeburn farmer, though it was possibly a coincidence, seems sufficiently striking to be worth relating: To a mob of 140 old ewes he put Romney, Corriedale, and Shropshire Down rams, and 114 lambs were born, of which half were sired by the Shropshires. The lambs all appeared to thrive equally well, but, while 12 per cent. of the Romney and Corriedale progeny were affected and died, none of the Shropshire crosses suffered at all. There are some grounds for thinking this to be other than a mere coincidence, and the point will be inquired into further.

Age: As already stated, there are rare cases where older lambs are affected, but in the vast majority of cases the lambs which die are from two and a half to four weeks old—that is, in about the fourth week of life.

Twin lambs: While these are not entirely immune, the deaths among twins are negligible in number compared with those among singles.

Condition: One of the most striking facts about this disease is that the lambs dying of it are invariably in extremely forward condition. It occasionally happens that lambs die of the disease on pasture which appears to be rather poor than otherwise; but here, as in all other cases, the size, weight, and fatness of the carcase were quite remarkable for a lamb of that age.

Nature of Pastures where Deaths occur.

The following two subsections (ending on page 222) are an abstract of a report by Mr. E. Bruce Levy, the Department's Agrostologist, dealing with the pastures of the district under investigation from two points of view—(1) food-production, and (2) the possible presence of a poisonous weed or weeds which might cause the losses.

FOOD-PRODUCTION.

The pastures on which the greatest mortality occurred consist of the following grasses and clovers: Perennial rye-grass, white clover, suckling-clover, and Poa pratensis, and small quantities of cocksfoot, crested dogstail, English trefoil, and red clover. The following are botanical analyses of certain of these pastures:—

Analysis No.	1.	2.	3.	4.	5.	6.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Bare ground	1	16	14	41	45	44
Perennial rye-grass	51	52	55	78	50	60
White clover	30	12	7	10	1	15
Suckling-clover	..	25	14	..	22	13
Poa pratensis	8	1	18	..	..	..
Crested dogstail	6	1	..	..	..	..
Goose-grass	..	4	..	7	10	3
Hair-grass	..	1½	1	1½	5	..
English trefoil	..	1½	..	..	..	..
Cocksfoot	..	..	..	..	..	..
Red clover	..	..	..	..	..	3
Yorkshire fog	..	..	..	..	..	2
Weeds (catsear, &c.)	5	2	5	3½	12	4

On examining these analyses it is readily seen that rye-grass, white clover, and suckling-clover form the bulk of the food the ewe is getting, and this irrespective of the fact that in many paddocks virtually half the area is bare ground.

On pastures that were poorer in composition than those tabulated the mortality was not so high. Bulk of food such as is provided by lucerne, young luscious grass, or young pasture with a good proportion of red clover in it seems also to reduce mortality. The following are analyses of paddocks where virtually no losses occurred :—

Analysis No.	7.	8.	9.
	Per Cent.	Per Cent.	Per Cent.
Bare ground	16	35	11
Perennial rye-grass	1	44	12
White clover	9	29	16
Suckling-clover	22	..	..
Poa pratensis	1	..	..
Goose-grass	22	..	25
Hair-grass	23	..	39
Chewings fescue	3	..	..
Red clover	..	27	..
Weeds	19	..	8

A number of other old pastures where no deaths were occurring were carefully examined, and in the majority of these the absence of springing rye-grass and clover was quite marked.

In Maniototo the old pasture rye-grass is short and nutty, and is probably the most highly concentrated rye-grass to be found anywhere in New Zealand. A significant fact is that in some parts of Taranaki where sheep pastures have been top-dressed to improve their feeding-value the mortality among fat lambs has notably increased. A mixture of white clover and rye-grass is excellent for milk-production by ewes, and its good qualities are enhanced in Maniototo by the large amount of available phosphate in the soil (larger than elsewhere in New Zealand) and by the low rainfall, which results in a short, nutty growth. This latter fact is of much importance. A luscious, watery growth has not the same food value, bulk for bulk, and, moreover, has a tendency to scour the animal and thus reduce the milk-yield. On the whole, conditions in Maniototo at this time of the year (late spring) are ideal for the production by the ewes of large quantities of milk, which their lambs never seem to tire of taking. Young lucerne, for example, which is a highly concentrated food as far as its dry matter is concerned, contains much water, so that *bulk for bulk* it is not as good a milk-producing food as the rye-grass and white-clover mixture. It has, in addition, a tendency to scour the ewe owing to the amount of protein present in it. Red clover, similarly, is a bulky food, and its presence to the extent of 27 per cent. in the foregoing analysis No. 8 probably accounts for the absence of deaths in that excellent pasture. Again, as grasses mature and approach the seeding stage their value for milk-production declines ; the same applies to spelled and rough pastures.

Systematic work on the relative food values, mineral content, &c., of the common grasses and clovers from different soil types, and at

all stages of growth, would greatly facilitate an investigation of this kind.

The farmer who suffers these losses should do his utmost to regulate the quantity and quality of food the ewe is getting as the lamb approaches the danger line—that is, during its third or fourth week. The following practices suggest themselves :—

(1) Where all the paddocks are in good, old rye-grass and white clover, concentrate the ewes and lambs on a smaller area. Although many paddocks show a large proportion of bare ground, it must be remembered that if the pasture there is of the type indicated, and the place be lightly stocked, the ewes can still get ample of this highly concentrated food to produce excessive quantities of milk. Overstocking during the danger period is the only way to overcome this.

(2) Grow more young pasture and bulky foods such as lucerne and red clover. The inclusion of red as well as white clover with all pasture sowing would help in rendering the young pastures more bulky, and in addition to its other uses the growing of more lucerne would provide more winter hay, so that more ewes could be carried.

(3) Shift and drive the ewes and lambs daily before and during the danger period.

The elimination of rabbits is having a bigger influence on the vegetation of the district than most farmers realize. The young spring growth that usually was eaten or spoilt by rabbits is now available for sheep, and an increased milk-flow from the ewes follows as a natural course.

THE POISONOUS-WEED THEORY.

Regarding the possibility of some poisonous plant being responsible for the disease, the common weeds of the Maniototo country are the following : Catsear (*Hypochoeris radicata*), dandelion (*Taraxacum officinale*), sorrel (*Rumex acetosella*), storksbill (*Erodium cicutarium*), willow herbs (*Epilobium* spp.), cudweed (*Guaphalium collinum*), Californian thistle (*Cnicus arvensis*), Scotch thistle (*Carduus lanceolatus*), speedwell (*Veronica Buxbaumii*), slender chickweed (*Cerastium triviale*), short-stalked cranesbill (*Geranium sessileflorum*), and mouse-eared chickweed (*Cerastium vulgatum*). To these may be added certain inferior weed grasses as follows : Goose-grass (*Bromus hordeaceus*), hair-grass (*Festuca bromoides*), English hair-grass (*Aira caryophyllea*), and desert poa (*Poa Maniototo*).

Throughout the tussock country there is also a great assortment of weeds and small indigenous herbs, comprising the following species : Yellow oxalis (*Oxalis corniculatus*), silky cotula (*Cotula perpusilla*), piripiri (*Acaena* spp.), colobanth (*Colobanthus brevisepalus*), scabweeds (*Raoulia* spp.), New Zealand field daisy (*Lagenophora pumila*), New Zealand violet (*Viola Cunninghamii*), forget-me-not (*Myosotis pygmaea*), Buttercup (*Ranunculus lappaceus*), New Zealand broom (*Carmichaelia Petriei*), patotara (*Leucopogon Fraseri*), swamp lily (*Chrysobactron Hookeri*), wild irishman (*Discaria toumatou*), porcupine scrub (*Hymananthera dentata*), cushion pimelea (*Pimelea sericeo-villosa*.

The only one of this list which might be suspected is the cushion pimelea, since in Taranaki and Wairarapa an allied species—Strathmore weed—has been known to cause deaths among horses. However,

in Maniototo the cushion pimelea is commonest on the harder, poorer country, where the lamb mortality is light or absent, and on the higher country up to 2,000 ft. where this disease does not occur. On many of the farms where the mortality is highest this plant is entirely absent.

It can be definitely stated that no other of the foregoing weeds is poisonous, and the weed-poison theory for the trouble may be ruled out. [End of abstract of Mr. Levy's report.]

Symptoms and Post-mortem Lesions.

In the vast majority of cases of the disease no symptoms are seen, lambs apparently in excellent health being found dead a few hours later. Generally they are found dead in the morning, and the bodies are usually near the nightly camping-ground. Through the kindness of several of the farmers sick lambs were brought to headquarters, and a few were seen on the farms. In only six instances, however, was it confidently felt that they were suffering from the disease in question. The symptoms in these instances were as follows: The lamb lay stretched on its side, the expression was drawn and suggested considerable pain, head stretched out, breathing rapid and jerky, pulse small and ranging from about 90 to 100, heart-sounds dull, and membranes of the mouth and eye showing a blue tinge. At short intervals there was given a choking bleat, suggestive of extreme pain, the whole body quivered for a while, and then became quiet until the next spasm occurred. These lambs were all killed while in this condition in order to obtain perfectly fresh specimens and to observe the state of the organs in such circumstances.

Before dealing with the condition found in these six cases it will be as well to describe what is seen at the more usual post-mortem—one held upon a lamb found dead. In these the abnormalities found were as follows (nearly one hundred cases showing these lesions having been examined): Kidneys: The outer portion of kidney substance (cortex) is reduced to a red, jelly-like pulp, the central part being less affected and sometimes quite firm. Both kidneys are affected in all cases. Sometimes a red, mottled appearance is seen before the kidney capsule is cut. This is due to hæmorrhage in the substance of the organ, and is not, as farmers often imagine, an indication that only parts of the kidney are affected. Liver: This is intensely congested with blood, so that on cutting into it this fluid oozes out in large quantities. Heart: The sac in which the heart lies (pericardium) is distended to a variable degree with straw-coloured fluid, in which, if the lamb has been dead some time, one finds yellow clots of fibrin. On cutting into the heart one finds in the lower cavities (ventricles) slight hæmorrhages under the lining membrane. Apart from these, there are no other noteworthy lesions found in the carcase.

In the case of a lamb killed while suffering from the disease the same lesions are found, except that the kidneys, although enormously congested with blood, are still quite firm. The pulpy condition develops very quickly after death, and results from the enormous quantities of blood imprisoned in the kidney vessels pressing on and distending the tissue, and subsequently clotting and shrinking there.

Deaths of Lambs from other Causes.

As stated in the introduction, it was thought highly probable that many deaths occurred which by the farmers were attributed to this disease while in reality they were due to other causes. This proved to be the case, and the following brief notes may be of value to farmers in enabling them to assess the true position more accurately in future :—

MARKING.

Odd cases of blood-poisoning occur, but are usually recognized as such by the farmer.

Hæmorrhage following the marking of ram lambs is probably a much commoner source of loss than is realized. Several farmers stated that they had observed this condition, and the following instance shows its importance : A report was received that several lambs were dead in a mob which had been marked the previous day, and a visit was made forthwith. Eleven dead lambs were found, and of these seven were males, which had quite obviously died as a result of hæmorrhage, the whole available space in the abdominal cavity being filled with clotted blood. One of the remaining four was obviously mismothered, and the other three—ewe lambs—were dead of causes other than so-called "pulpy kidney."

BLOATING.

Bloating is a danger which should be duly considered by the farmer where luscious feed, such as lucerne and even young grass or oats, is used for depasturing ewes and lambs. The danger is not great when the stock are on these feeds constantly ; for example, ewes can be lambed on lucerne and kept there without much risk. The danger lies in giving stock a brief spell on such feeds. The food is attractive and appetizing, and, being unaccustomed to it, the lambs are very liable to eat it too greedily. The following instance of this shows the danger well : A farmer who had about five hundred lambs this past season drove them daily some distance along a road to a lucerne paddock, where they grazed for an hour or so and were then driven back to their paddocks. Out of thirty-six fat lambs which died, thirty of the deaths resulted from bloating.

WANDERING AND BLIND LAMBS.

Although in the aggregate a large number of lambs are affected in this way, the loss to the individual farmer is not great, the largest loss encountered from this cause being 1 per cent. The condition is a peculiar one and easily recognized. The affected lambs wander dully round, with the head held low, and in nearly all cases in a one-way circle, either always to the left or always to the right. The circle may be large, or so small that the lamb turns round and round on its own axis. Some of them wander aimlessly in any direction. In either case, when their wandering brings them to any solid obstacle, such as a bush or fence, they bore into it with their heads and lean forward on it. Examination shows them to be blind in one or both eyes, though the eyes appear quite normal. If the lamb is blind in the right eye it wanders in a circle to the left, and *vice versa*. Several post-mortem examinations were held on lambs so affected, and in all

FIG. 1. BLIND LAMB TURNING IN A CIRCLE.

FIG. 2. LAMB WITH TETANIC SYMPTOMS.

cases there was marked fatty degeneration of the liver, the tissue being very noticeably yellow in colour; there was much bile-stained mucus in the duodenum (intestine leading out of the fourth stomach), and in some cases there seemed to be an excessive amount of fluid in the cranial cavity. Probably this latter exists in all cases, but it is exceedingly difficult to estimate at a post-mortem conducted in the field.

Some lambs so affected recover automatically, though they rarely thrive afterwards. One ewe was seen which, as a lamb, had wandered in a circle. She was well grown and a good mother, but was very excitable and would not go with the rest of the flock. Examination showed her to be blind in the left eye still, though she no longer wandered in a circle. If it is considered desirable to attempt treatment in such cases, the best results are obtained by withholding all food for a few days, keeping the lamb in a dark, quiet place, and giving a daily dose of ½ oz. to 1 oz. of Epsom salts. When improvement commences a little milk can be given. Fig. 1 shows a typical case of this trouble.

TETANY.

Apart from occasional cases of lockjaw, resulting from infection at marking-time, there is a fairly common condition which closely resembles this disease in the symptoms shown. One good reason for mentioning it is the opinion expressed by several farmers that it might be due to strychnine poisoning. While its actual cause is not definitely known, it does not appear to be either lockjaw or strychnine poisoning. It was possible to entirely rule out the latter possibility in numerous cases where careful inquiry was made. The possibility of its being due to what is known as alkalosis, which is typically manifested by tetany, was duly considered and disproved. Post-mortem examination revealed that there was very intense constipation in all such cases, and this, together with the fact that manipulation of the abdomen in the lamb before death caused intense pain, suggests this as the cause of the condition. Marked and unmarked lambs are equally liable. Fig. 2 shows a typical case.

Preventive Measures advocated.

EFFECT OF MARKING.

Reference to the following table will make it easy to understand why many farmers in the district have no faith in marking as a preventive measure.

Farm.	Total Number of Fat Lambs lost.	Before Marking.	After Marking.
1	70	43	37
2	24	10	14
3 (one paddock only) ..	9	4	5
4	30	10	20
5	60	30	30

Closer consideration, however, shows that these figures are not a true indication of the efficacy or otherwise of this method.

No. 1 Farm, as is usual in the Maniototo district, had only one marking. Many of the lambs were very young at the time, and such check as they received was quite overcome by the time they reached the danger age. Lambs were dying rapidly before marking; several died just before or immediately after the operation. Then there was a lull of several days till the younger lambs overcame the check and reached the danger age. The same remarks apply in general to Farms 4 and 5.

No. 2 Farm: Of the fourteen lambs which died after marking, the death of at least eleven was from other causes, these being the eleven previously referred to in connection with hæmorrhage after marking.

No. 3 Farm: Four of the deaths after marking occurred on the second day. No post-mortems were made, but the fact that nearly half the total death-rate in that paddock occurred on the second day after marking, and that three of the four lambs which died that day were males, is strongly suggestive of some cause associated with the operation.

The fact that, whereas the sexes are equally affected prior to marking, more of the ewe lambs die afterwards is undoubtedly significant, since the ewe lambs get a much slighter check. In general only one marking is held, and as the ewes are not drafted into mobs as they lamb it is impossible to draw any conclusions regarding the matter which will stand close criticism. Only one man was met with who drafted his ewes and marked systematically, keeping records of his losses. Fourteen lambs died before marking, and sixteen afterwards; but on his own statement he did not open many of the carcases, and of those he did examine only a few showed "pulpy kidney."

The co-operation of some of the farmers will be sought next season to test the method carefully under properly controlled conditions to avoid erroneous conclusions.

EXERCISE.

Many farmers stated that they had tried exercise and found it useless, but on closer inquiry it turned out that they had only commenced moving the lambs about when several had died, and the average age was three to four weeks. As with marking at a given age, so with moving the stock, the fact that the ewes are not drafted as they lamb makes it impracticable to exercise properly. Speaking generally, the bulk of the lambing extends over about three or four weeks, and consequently in a given paddock there are lambs three weeks of age, which may be found dead almost any hour, mixed up with newly dropped lambs and ewes still pregnant. Obviously it is impossible to exercise such a mixture of stock adequately.

The following instances go to show how easy it is for a suggested preventive measure to get into disrepute:—

"A," who had numerous losses from "pulpy kidney" in 1924, tried exercise in 1925, and apparently derived much benefit from it. This season he exercised again, depasturing daily on to lucerne, after driving some way along the road. (This case is referred to in connection with bloating.) He lost twenty lambs in a comparatively short time, and was attributing his loss to the disease under investigation, till a visit to his farm and a demonstration on a freshly dead lamb showed him conclusively that bloating was the trouble. Up to my departure from the district he had lost thirty-six fat lambs in all—thirty by his own account from bloating, five from the wandering sickness already referred to, and one from pleurisy, but none from "pulpy kidney."

"B" had suffered heavily, and in 1925 made a thorough effort to prevent the disease. In addition to marking, he docked four

times at fortnightly intervals, and provided exercise by driving in batches from the paddocks to a field of green oats for an hour or two daily. His losses were heavier than in the previous year, when no precautions were taken. As far as is known, none of these lambs was opened; but in the light of "A's" experience this year it is more than probable that here again the deaths were due to bloating.

An objection often raised by farmers when urged to exercise their lambs is that it will give them such a check that they will not be in the first grade when drafted to the freezing-works in the autumn. Having this in view, it is intended to carry out experiments in exercising lambs, and to ear-tag the experimental animals so that they can be watched at the grading-scales when killed.

OVERSTOCKING OR PLACING ON BARER PADDOCKS, ETC.

The desirability of these courses, before and during the danger period, has already been stressed in the abstract of Mr. Levy's report. It will suffice to give a few instances where these methods were tried.

(1) A mob of 250 ewes with 280 lambs were running on a good, old, white-clover and rye-grass pasture. Fifteen lambs died there. The mob was then crammed on a 50-acre paddock of young rye-grass and left there. Three lambs died next day (no post-mortem made—deaths possibly due to bloating), one died the following day, and two more a week later, after which all trouble ceased.

(2) On the same farm 113 ewes in not very good condition were placed on 60 acres of grass at lambing and left there. No deaths occurred at all.

(3) In this case there were 202 ewes with lambs. Four lambs died up to 23rd October, on which day they were marked. On the 24th three lambs died (one from blood-poisoning), and the mob was moved to a bare paddock. No deaths occurred after the move. Returned to good pasture on 7th November, and still no deaths occurred.

(4) This was another mob on the same farm as (3)—208 ewes with lambs. Four deaths occurred up to 27th October. Marked on that day and placed on good pasture. Deaths continued up to 7th November, when they replaced the previous mob on the bare paddock. Deaths ceased from that day.

(5) An interesting experiment was carried out by a Gimmerburn farmer. Out of a mob of 290 lambs twelve died, presumably from "pulpy kidney." He then took the ewes and lambs off the paddock and yarded them. The older ewes were kept in the yards for fourteen hours, and again for a similar period four days later. The younger ewes were given one spell of twenty-four hours in the yard. With the exception of one lamb which died while yarded up, the losses stopped in this mob from the time the experiment began.

EWE'S CONDITION AT LAMBING.

So many factors come in to fog the field of inquiry in this connection that nothing in the way of definite evidence could be obtained either one way or the other. As will appear later, the amount of milk yielded by the ewe is of great importance, and it is well known, both with cows and sheep, that a beast that is "done" well during the winter will

milk better than she would have otherwise. When the dam is in good order at parturition she tends to give abundant milk for a considerable period, even when the diet she gets at that time is not of first quality, because during the dry period reserves of materials have accumulated in the body from which she can draw supplies for milk-production. This may be the explanation of the occasional deaths from the disease among lambs on poor pasture. In any case, that the ewes in these instances are somehow finding the wherewithal to feed their lambs extraordinarily well is shown by the bodily condition of those which die. Another fact having a bearing on this side of the question is that losses are very noticeably slighter among the progeny of two-tooths than among that of maturer ewes.

Laboratory Examination of Specimens.

It would serve no useful purpose in an article of this nature to go into technical details concerning individual specimens examined at Wallaceville. Such bacteriological work as was done yielded no evidence whatever of an infecting germ being causative of the disease. Examination of portions of affected kidney afforded no evidence that the condition found in them was the result of an attempt to eliminate any poisonous material. As already stated, the pulpiness is the result of extreme engorgement with blood prior to death. Examination of the liver showed intense congestion with blood, and the liver-cells appeared to be loaded to a somewhat unusual extent with a substance, probably glycogen—the form in which the body stores up its carbohydrates (starches and sugars)—and in addition showed a varying degree of fatty infiltration. It seems very possible that these points in connection with the liver-cells have a profound bearing on the subject.

Thanks to the co-operation of four of the local sheepfarmers we were able to secure some hundreds of samples of blood from ewes and lambs. The object of this was to discover by periodical analysis of blood from individual ewes and lambs whether there was any noteworthy change as the lamb approached and passed the danger age. As already stated, the kidney lesion is the most obvious one in this disease, and it was thought that possibly the kidneys were not functioning properly for some time before death ; that consequently waste products were accumulating in the blood ; and that when these products reached a certain limit acute illness and more or less sudden death resulted. However, these samples and certain others procured from lambs suffering from the disease have served the very useful purpose of disproving that idea. There is no accumulation of nitrogenous waste products, nor of chlorides, in the blood of affected lambs ; consequently it must be readily understood that there is no impairment of the kidneys' excretory function prior to the sudden onset of the illness.

In view of an opinion expressed publicly in Southland last December it appears desirable to lay still further stress on the following point : There are good grounds for thinking that prior to the onset of acute symptoms the kidneys are normal and function normally. Before death the kidney is enormously congested, and in specimens obtained at that time the kidney-cells, including the lining cells of the tubules, are still normal, apart from a trifling degree of cloudy

swelling which is readily accounted for by the pressure exerted on them through the distension resulting from such extreme congestion. This is in direct contradiction of the statement in question that "the kidney-tubes are destroyed." When the kidney becomes pulpy after death the tubes may with some truth be described as "destroyed," but this is a post-mortem change. It is hoped that the present statement, together with the results of Mr. Levy's exhaustive botanical survey of the affected area in Maniototo, will prevent further eruptions of the "poisonous-weed theory."

Tentative Conclusions from the Season's Work.

The outstanding facts upon which theories can be based are as follows: (1) The disease occurs with extraordinary regularity at a definite period lasting approximately three weeks; (2) affected lambs (typically affected with the disease as judged by kidney, liver, and heart lesions) are approximately three weeks of age, are in exceptionally forward condition, and are taking grass as well as milk; (3) although deaths occasionally occur on poor country, the type of lamb to die is always as just stated.

The type of lamb to die is quite definite, so that its primeness must be either the cause or the predisposing factor in the condition. Regarding the age of the lambs, and the season when the deaths occur, it is about that age that the lamb has started grazing, and at that season the greater part of the herbage is in the leafy stage prior to the shooting of the flowering head—that is, at the most potent stage for promoting milk-production; moreover, its nitrogenous components are undergoing rapid changes from the non-protein to the protein form. (In passing it is worth noting that there appears to be nothing definitely wrong with the ewe's milk except its great quantity; motherless lambs are frequently twinned on to ewes whose lambs have died of "pulpy kidney," and do quite well.)

These points, taken in conjunction with all that has gone before, suggest the following: A quickly developing type of lamb is supplied with abundance of milk from birth; it reaches in an overfat condition the age when grazing commences; it is plethoric and lazy, and its digestive organs are consequently lacking in tone and sluggish in their action. At this stage the nature of the pasture increases the milk-yield of the ewe, thus throwing extra strain upon the lamb's alimentary tract, and, through this, on its system generally. The lamb now starts picking about for itself, and in the course of a day not only ingests a large quantity of milk, but also a varying amount of highly nutritious herbage. It seems feasible to think that the atonic digestive organs, already fully occupied in dealing with a copious milk diet, may not be able to deal effectively with the various protein breakdown products derived from its own tissues (muscles, &c.) and from the intestine. Sundry poisonous products of this nature are normally formed in the body, and in a state of health are dealt with by the liver in such a way as to render them non-toxic. (As already mentioned, there is a strong suspicion that the liver-cells are overloaded with glycogen and fat in cases of this disease.) Some such products do have a profound effect upon the blood-circulation, and, as it has been endeavoured to show,

the lesions found in "pulpy kidney" disease are due to circulatory disturbances.

It must be clearly understood that the preceding paragraph is not intended as a statement of fact. It appears, however, to be the theory which best fits the case, and it is felt that herein lies the most hopeful working hypothesis for future technical investigation. Additional bacteriological and other work will also be undertaken.

The occasional cases of this disease occurring in older lambs later in the season are highly interesting. The recent instance referred to affected fifteen stud lambs in high condition that had been rounded up for dipping. The remainder of the lambs were promptly weaned and no further losses occurred. Such instances rather support than detract from the probability of the theory outlined.

Suggested Experiments in Prevention for Next Season.

Whereas investigation on the foregoing lines is a matter of great scientific interest, actual practical results—in other words, a saving to the farmer's pocket—can be accomplished only by properly controlled experiments with the various preventive measures that are advocated. For these trials controls are essential, and preferably should embrace a fair half of the flock. Experimental mobs must be drafted into batches according to lambing-dates.

It is hoped that co-operation will be forthcoming to try the following: Daily exercise, commencing at ten days of age; docking at fourteen days and marking at, say, eighteen days of age; yarding ewes and lambs nightly; yarding ewes and lambs at other and various intervals; overcrowding without exercise or extra marking; combinations of overcrowding, exercise, and extra marking; use of various crops such as lucerne, young grass, &c.; feeding ewes during pregnancy with the object of lowering the milk-yield.

The ewes must be duly selected so that they are fairly representative. Post-mortem examination must be made by a veterinarian on all lambs dying in experimental flocks, and for future identification at the works experimental animals must be given numbered ear-tags.

It will be appreciated that the work of arranging and supervising a programme of this sort will be very considerable, and it is hoped to make an early start.

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In conclusion, I have to make due acknowledgment of the help received from Mr. David Weir, Stock Inspector at Ranfurly. His knowledge of the district and of the local farmers was most useful, and the large amount of additional work which was entailed upon him was always well and willingly done. Mr. P. McGregor, Government Veterinarian, was associated with me during part of the investigation, and his help was much appreciated. The authorities and staff of the Medical School, Dunedin, have my sincere thanks for the facilities afforded me, and particularly Miss S. Woods, M.Sc., who carried out the analyses of blood-samples, which lack of facilities at Ranfurly made it impossible to perform there. Professor Malcolm, of Otago University, took a very keen interest in the work, and his kindness in placing his knowledge of physiology at my disposal was greatly appreciated and very helpful.

MORTALITY AMONG LAMBS IN CENTRAL OTAGO.

CHEMICAL ANALYSES OF PASTURES, MILK, AND SOILS.

B. C. Aston, F.N.Z.Inst., Chemist to the Department of Agriculture.

The soils of Central Otago, which are derived from the mica-schist rocks, have so far upon chemical analysis yielded a high amount of "available" phosphoric acid soluble in a 1-per-cent. solution of citric acid, as in the Dyer method for determining available plant-food (see this *Journal*, Vol. 26, No. 6, p. 329). The fertility of the Otago Central soil is proverbial, and is probably due to the high amount of available phosphate present.

Mechanical analyses of soils upon which mortality among lambs occurred last spring compared with one on which there were no deaths from "pulpy kidney" show that there is no perceptible difference in the physical composition of the soils. Chemical analyses, however, show that the available and total phosphate in the soil of the property upon which no mortality occurred is much lower than in those analysed from farms upon which the losses were heavy. From this one may infer that, other factors being equal, the land where the lambs enjoyed immunity from this trouble would not grow such a rich pasture as that upon which the trouble was rife.

The results of the pasture analyses presented in Table 1 show that most of these samples are contaminated with sand or silt, but Nos. 794 and 795 have all the characters of pure samples. The column headed "Fusion of Silica and Sand" represents the fusion of the hydrochloric acid insoluble portion with carbonate of soda. From these ash-analyses one can say positively that the mineral foods given are present in good proportions, and there is no reason to suspect mineral deficiency.

The question arose whether the composition of the milk which the mother ewes gave—the milk being the largest portion of the diet of the lambs which died at the age of between four and five weeks—was in any way abnormal. The reply the writer gave to this was that, the ewes being healthy and on natural pasture, it was unlikely that there would be any change in the composition of the milk; that improved condition of diet or climatic environment would be reflected more in a change of volume of milk yielded than in change of composition. To test the matter fully, arrangements had to be made for the transport of the milk some hundreds of miles to the Laboratory at Wellington. This was effected by the use of thermos flasks. The ewes' milk, being much thicker than cows' milk, did not churn in the flasks. The samples were placed in the flasks after thorough cooling, and arrived at the Laboratory in good condition for analysis, without the use of preservatives.

The results of the analyses of the ewes' milk are shown in Table 2. A much more extensive series of analyses is required before expressing any positive opinion, but the results go to show that there is no great abnormality, and that the constituent that changes at all is, as in cows'

Table 1.—Chemical Analyses of Pasture.

The results are expressed as percentages of the sample dried to constant weight in water oven. Analysis performed on the ash for minerals. The insoluble silica, sand, and silt was fused with carbonate of soda and the constituents determined.

Sample.	Locality.	Description.	Total Nitrogen.	Crude Ash.	Silica, Sand, and Insoluble Matter.	Silica.	Iron, Fe.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Manganese Oxide, Mn_3O_4.	Sulphuric Anhydride, SO_3.	Carbon Dioxide, CO_2.	Fusion of Silica and Sand.		
														Alumina, Al_2O_3.	Lime, CaO.	Iron, Fe.
W/728	Kyeburn ..	Pasture ..	{2·71 2·77}	13·45	5·46	5·02	0·056	1·198	0·97	0·55	0·015	0·806	0·13	0·22	0·084	0·010
729	Eweburn ..	Pasture ..	{2·74 2·74}	12·80	5·94	5·43	0·050	0·955	0·85	0·51	0·026	0·490	0·15	0·24	0·080	0·009
730	Gimmerburn ..	Lucerne ..	5·38	12·79	3·75	..	0·019	1·346	2·77	0·67	0·007	0·740	1·69	..	..	..
758	Ranfurly ..	Pasture, chiefly clover	3·90	11·40	2·16	1·88	0·055	1·016	1·76	0·63	0·011	0·380	1·34	0·16	0·075	0·006
759	Gimmerburn ..	Pasture ..	2·14	11·71	5·12	4·76	0·039	0·981	0·76	0·47	0·013	0·880	0·04	0·06	0·069	0·005
762	Kokonga ..	Mixed pasture ..	{2·95 2·96}	11·01	3·89	3·52	0·068	0·821	1·04	0·51	0·027	0·520	0·19	0·16	0·087	0·006
791	Kyeburn ..	Pasture ..	2·42	11·79	6·42	5·77	0·077	0·705	0·71	0·44	0·025	0·540	0·08	0·26	0·140	0·010
794	Wedderburn ..	Pasture ..	3·05	10·09	2·55	2·41	0·014	0·728	1·32	0·63	0·016	0·520	0·52	0·03	0·030	0·001
795	Wedderburn ..	Pasture ..	3·48	10·28	2·42	2·28	0·022	0·820	1·36	0·57	0·019	0·730	1·07	0·04	0·040	0·002
812	Wedderburn ..	Pasture ..	1·65	8·98	8·24	3·93	0·044	0·686	0·73	0·48	0·029	0·610	0·11	0·14	0·110	0·003
813	Wedderburn ..	Young rye-grass	1·65	9·43	3·31	3·19	0·016	0·771	0·64	0·41	0·016	0·608	0·13	0·06	0·080	0·001
814	Wedderburn ..	Enclosed pasture area	3·12	11·80	3·20	2·96	0·034	0·971	1·00	0·62	0·010	0·790	0·28	0·14	0·070	0·006
822	Ranfurly ..	Pasture ..	2·31	9·71	4·18	3·85	0·024	0·747	0·80	0·43	0·016	0·710	0·13	0·07	0·080	0·002

NOTE.—Figures in brackets are duplicate determinations.

[*Analyses by B. C. Aston and I. Cunningham.*

milk, the fat. That the flow or yield of milk is exceptionally high there is some evidence, but further experiments are necessary to give accurate figures.

Table 2.—Analyses of Ewes' Milk.

Sample.	Locality.	Fat.	Proteins. (N × 6·39.)	Total Solids.	Ash.	Remarks.
W/756	Kyeburn, No. 44 ..	2·5	4·6	13·9	0·98	Twin lambs.
757	Kyeburn, No. 39 ..	3·1	4·4	13·8	0·90	Single lamb.
760	Eweburn, No. 83 ..	4·9	4·4	15·2	0·98	Single lamb.
761	Eweburn, No. 75 ..	2·3	4·5	12·8	0·99	Twin lambs.
793	Kyeburn ..	4·3	4·4	14·6	0·96	Single lamb (died).
796	Gimmerburn ..	2·8	4·5	13·4	0·97	Twin lambs.
797	Gimmerburn ..	3·6	4·4	13·9	0·93	Single lambs

[*Analyses by F. T. Leighton.*

The fact that the mortality begins and ends so suddenly seems to be evidence of some seasonal change in the chemical composition of the pasture concomitant with early spring growth. Very early lambs do not fall victims, neither do late lambs, the period of maximum intensity of the mortality being from 20th October to 8th November. The fact that twin lambs do not suffer seems to be evidence that the milk is not poisonous but may be present in excessive amounts, and therefore more than the single lamb can assimilate without suffering in health. Either of these two hypotheses may be correct, or they may be operating jointly to produce the result.

The pasture samples were analysed for total nitrogen, with the results stated in the table. The result shows that nitrogen is not present in abnormally high amounts, except perhaps in one Wedderburn pasture (W/795). Godden (*Journal of Agricultural Science*, Vol. 16, p. 87, 1926) gives the analysis of a highly manured horse-paddock at Taplow as 3·562 per cent. nitrogen in dry matter, compared with average of cultivated pastures, 2·830 per cent.

There is the question whether the nitrogenous matter is present in the form most suited as food for the young lamb, and this is an aspect which will engage the attention of the Department's chemists during the coming spring. The few samples received were examined to determine if there was any radical difference between the chemical composition and the nitrogenous constituents of the Otago pastures with those of normal pastures elsewhere. The number of samples received is too small to warrant drawing any definite conclusions from the results, but the figures suggest lines for future work. The crude protein and true protein may be found to increase with the increase in mortality. There are wide variations in the figures for "amides" and for ratio protein/amides, which may be due to inadequate sampling. Results obtained from the Welsh Plant Breeding Station* showed great variations in composition in two consecutive years.

It appears desirable to continue the investigation, taking more adequate samples from a number of "healthy" and "unhealthy" farms over a period of years.

* Fagan and Jones: "The Nutritive Value of Grasses as shown by their Chemical Composition" (University College of Wales, Aberystwyth, Series H, No. 3, Seasons 1920–23).

Table 3.—Crude Protein, True Protein, and "Amides" in Pasture Samples from Central Otago, arranged in Approximate Order of Normality of Pasture—late October and early November, 1926.

Sample.	Crude Protein, per Cent. (N × 6·25.)	True Protein, per Cent.	Amides, per Cent.	Ratio: True Protein to Amides.	Remarks.
W/791 ..	15·12	12·31	2·81	4·4	Healthy pasture.
729 ..	17·19	12·25	4·94	2·5	Healthy pasture.
814 ..	19·50	13·63	5·87	2·3	Affected pasture.
759 ..	13·38	10·50	2·80	3·7	Affected pasture.
728 ..	17·38	12·50	4·88	2·8	Affected pasture.
762 ..	18·56	13·63	4·93	2·8	Affected pasture.
794 ..	19·26	14·56	4·70	2·3	Badly affected pasture.
822 ..	14·43	10·81	3·62	3·0	Badly affected pasture.
795 ..	21·81	14·75	7·06	2·1	Badly affected pasture.
Average ..	17·40	12·77	4·63	2·8	

[*Analyses by L. D. Foster.*

SUMMARY OF ANALYSIS OF PASTURE SAMPLES (TABLE 3) AND SOILS (TABLES 4 AND 5).

Pasture Samples.—(1) Compared with figures obtained from rye-grass grown and examined at the Welsh Plant Breeding Station, the Central Otago pastures—in which rye-grass is the dominant grass—are higher in true protein and also in the ratio of true proteins to amides.

(2) Compared with composite pasture samples grown and examined at Cambridge, England, the Central Otago pastures are low in protein, but considerably higher in the ratio of true protein to amides.

(3) The healthier pastures in Central Otago have possibly a lower true protein/amide ratio than those where mortality occurs.

Soils.—(1) The mechanical analyses show no differentiation.

(2) The chemical analyses show these soils to be high in total lime and total potash. They are also high in available potash and available phosphoric acid. The soil taken from healthy land, however, contained about half the amount of available and also total phosphoric acid that was present in soils from affected farms. Otherwise the three soils were similar.

GENERAL REMARKS.

It is questionable to what extent a rich proteid diet would affect lambs or other ruminants, but physiologists have observed that an excess of protein in the diet of mother rats causes mortality in the young during the lactation period. There is, further, the possibility that at a certain early stage in the growth of the pasture in the rich Central Otago soils there may be an abnormally high percentage of non-proteid nitrogenous constituents, such as amides and amido-acid compounds, which would exert a further strain on the already over-taxed digestive organs of young lambs overfed with excessive milk diet. A familiar example of the effects of such bodies is that of asparagus, which contains asparagine in quantity. Asparagus is eaten by man when the plant is in an exceedingly young stage, and when it contains

Table 4.—Chemical Analyses of Soils.

Results, except *, are percentages on soil dried at 100° C.

Sample.	Locality.	Volatile Matter.			Total Nitrogen.	1 per Cent. Citric-acid Extract, Dyer's Method, Hall's Modification. ("Available Plant-food.")				Hydrochloric-acid Extract. ("Total Plant-food.")				Remarks.
		*On Air-drying.	* At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	
W/731	Kyeburn	..	1·30	5·13	0·158	0·195	0·040	0·023	0·035	1·18	0·55	0·74	0·10	Mortality.
732	Gimmerburn ..	..	0·74	3·63	0·113	0·187	0·046	0·021	0·042	1·32	0·50	0·68	0·09	Mortality.
733	Eweburn	..	1·20	5·57	0·193	0·175	0·034	0·026	0·022	1·45	0·47	0·76	0·05	No mortality.

Table 5.—Mechanical Analyses of Soils.

Results are percentages on air-dried soil.

Sample.	Description of Soil. (Classification of U.S. Dept. of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.							Stones and Gravel.	Remarks.
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture and Loss on Ignition.		
W/731	Between silt and fine sandy loam ..	1·4	10·3	37·3	22·1	19·4	5·7	1·3 5·1	..	Kyeburn: Mortality.
732	Between silt and fine sandy loam ..	1·3	10·8	43·4	21·8	14·7	5·7	0·7 3·6	..	Gimmerburn: Mortality, poor pasture.
733	Between silt and fine sandy loam ..	1·7	11·0	31·4	26·1	19·3	6·2	1·2 5·5	..	Eweburn: No mortality.

its nitrogen largely in the form of asparagine, a crystalline body which becomes changed in the more mature plant into insoluble protein. Such compounds as asparagine are usually abundant in the young growth of spring, especially in leguminosæ, whether those growths spring from rootstock or from seed. In the case of the Central Otago spring pastures, an abundant element coming from seed is the suckling-clover (*Trifolium dubium (T. minus)*), as it is an annual. It is quite possible that the grazing animal would obtain a sample of food differing from that picked by hand by the most careful sampler, and that hence samples sent to the analyst may not reveal the true richness of the sheep's diet in nitrogen.

The evidence seems to indicate that in years past the rabbits which overran the country mitigated the mortality by grazing off the very youngest and tenderest growth, but that now the rabbits are kept severely in check this growth is consumed by the sheep or lambs.

The whole question is a most interesting one, and requires close investigation by a chemist on the spot. Samples must be taken with great care through a whole season on different types of soil.

CONTROL OF BROWN AND BRONZE BEETLES IN THE ORCHARD.

Brown and bronze beetles are recognized to be very destructive orchard pests. The latter particularly is on the increase, and during the past season has been responsible for a considerable amount of blemishing of the apple crop. So far no satisfactory method of control has been devised, despite the fact that numerous experiments have been carried out over a number of years. The constitution of this pest is evidently too strong to render it amenable to the orchard arsenical sprays, consequently deterrent sprays at the time of attack suggest the greatest possibility of control. Unfortunately, none of those at present in use has been found to give very much relief.

However, Mr. H. R. John, of Te Teko, Bay of Plenty, claims to have secured a very satisfactory control from the use of Black Leaf 40. Black Leaf is a nicotine specific commonly used in orchard practice, but it has until recently attracted no great amount of attention as a remedy for bronze-beetle. In the course of a letter Mr. John writes :—

> The grass-grub or brown chafer beetles did not rise here till about the middle of January this year. As soon as they showed themselves on the trees in any number I sprayed with Black Leaf 40, and they left the trees alone altogether. A piece of ground badly affected in previous seasons, and the trees sprayed last year, was dug. On this piece of land only one plum-tree out of six has been attacked at all, and that very slightly. Since I sprayed for the beetle in January I have not noticed any on the trees, the only ones seen being in the ground where dug, and they appear to be dormant. I am convinced that this pest can be controlled greatly here, if not killed altogether, by using the Black Leaf spray.

A closer watch will be kept on the results of Black Leaf 40 elsewhere, in the hope that Mr. John's experience may be confirmed.

—*Horticulture Division.*

OAT-SMUT AND ITS CONTROL.

SURVEY AND EXPERIMENTAL WORK, SEASON 1926–27.

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

FARMERS in the South Island have lost this season approximately half a million bushels of oats—or, at 3s. per bushel, £75,000—solely through failure to disinfect their seed for smut. The statistics tabulated below, which were collected during January and February of this year, show that in Canterbury oat-smut has caused much greater losses than last year, while in Otago and Southland the amount of smut has been greatly reduced. These results may be in part due to seasonal variations in the severity of attack of the disease, but are certainly mainly due to the care or want of care respectively of farmers in the treatment of their seed oats. Certain districts in Otago and Southland which last year suffered very heavy losses show this year a mere trace of smut in the crops, due to the general adoption by the growers of proper methods of seed-disinfection.

In the Wairau Valley, Marlborough, an interesting position in regard to this disease was disclosed by the survey. Last year no smut was detected in the oat crops in this valley, and it is not the custom for growers there to disinfect their seed. Two crops of Algerian oats were, however, examined in the neighbouring Awatere Valley and found to contain a good trace of smutted heads. The seed for these crops had been specially imported from Canterbury to bring into the district a new strain, and, as is customary in Marlborough, had been sown without disinfection. This year twenty-four crops of oats scattered all over the district were found to contain oat-smut, and wherever the seed origin could be traced it was found to have been the product of the infected crops examined in the Awatere Valley the year before, or to have been directly imported from Canterbury. It seems probable, therefore, that unless the farmers of Marlborough disinfect their seed oats, as they do at present their wheat and barley, they will in the future suffer heavy losses through smut, and seriously impair the clean reputation of Marlborough chaff.

Details of this season's oat-smut survey are given in Tables 1 and 2, together with last year's figures for comparison. The methods used in collecting and estimating are the same as those used last year and published in the *Journal* for March, 1926, page 166. For computing the amount of the losses a bushel of oats has been taken as worth 3s. in both years.

PREVENTIVE TREATMENT.

There is only one way to prevent the occurrence of smut in oats, and that is to sow seed free from infection. Naturally smut-free seed is rare, but almost complete disinfection may be obtained with any line, however smutty, by steeping the seed in formalin prior to sowing. This method is cheap — costing about a penny per bushel of seed— simple to apply, and, if properly carried out, will not lower the percentage germination or vigour of the stand. Many farmers still use the bluestone pickle, but this method, while it reduces the smut to

Table 1.—Number and Condition of Oat Crops examined.

District.	Examined.		Clean.	
	1925–26.	1926–27.	1925–26.	1926–27.
Marlborough	12	52	10	28
Canterbury	35	256	18	79
Otago	100	129	12	30
Southland	110	115	11	5

District.	Smutted.					
	Trace to 1 per Cent.		1 per Cent to 20 per Cent.		Above 20 per Cent.	
	1925–26.	1926–27.	1925–26.	1926–27.	1925–26.	1926–27.
Marlborough ..	2	19	..	4	..	1
Canterbury ..	12	82	5	85	..	10
Otago	41	65	33	29	14	5
Southland ..	47	68	42	33	10	9

Table 2.—Estimated Losses from Oat-smut.

District.	Crops examined.					
	Area.		Actual Loss.			
	1925–26.	1926–27.	1925–26.	1926–27.	1925–26.	1926–27.
	Acres.	Acres.	Acres.	Acres.	Bushels.	Bushels.
Marlborough ..	398	1,219	..	7	..	198
Canterbury ..	1,175	5,901	13·8	201	534	8,844
Otago	5,119	2,609	528	50	26,434	2,176
Southland ..	2,362	2,711	157	112	6,076	5,152
Totals ..	9,054	12,440	698·8	370	27,044	16,370

District.	Statistical Estimate.					
	District Area in Oats.		Loss.			
			Quantity.		Value.	
	1925–26.	1926–27.	1925–26.	1926–27.	1925–26.	1926–27.
	Acres.	Acres.	Bushels.	Bushels.	£	£
Marlborough ..	15,000	15,000	..	2,600	..	390
Canterbury ..	187,000	202,000	84,915	302,465	12,737	45,370
Otago	82,000	78,000	326,938	64,500	49,040	9,675
Southland ..	71,000	66,500	182,277	126,380	27,341	18,957
Totals ..	355,000	361,500	594,130	495,945	89,118	74,392

small proportions, most certainly lowers the germinative energy of the seed. An examination of the detailed results of this season's experiments with both methods, which are given in Table 3, shows this clearly; but still more striking was the difference in vigour seen when the plants were growing side by side.

The method of treatment recommended is as follows: In a tin bath, wooden, iron, or concrete trough, or other receptacle, mix the formalin as purchased with water in the proportion of 1 pint of formalin to 30 gallons of water. Do not guess, but measure the quantities accurately, for on their correctness largely depends the success of the treatment. Put half of each sackful of seed oats into another sack, so

FIG. 1. OAT-SMUT.

[*Photo by H. Drake.*

that the sacks for treatment are not more than half full. Immerse the sacks and grain below the surface of the formalin solution for exactly ten minutes, moving the grain about several times while under. At the end of ten minutes remove the sack from the solution. A good method for this is by means of a block and tackle rigged over the trough, by which the sack can be lifted and left for a while suspended over and draining back into the trough. The sack is then thrown on the ground and the grain flattened out to an even layer within the sack. If the operation is performed in the evening the grain will be fit for sowing the next morning. Do not empty the grain into other sacks unless these have been previously disinfected.

Dipping may be continued in the same solution until the level is too low to cover the sacks, when fresh solution should be added made up in the same proportions — 1 pint to 30 gallons of water. A pint bottle of formalin costs 2s. 9d., and it will make enough solution to treat about 35 bushels of oats.

Some farmers obtain satisfactory results by shovelling the grain on the floor while sprinkling the formalin solution over it from a watering-can. If this method is adopted the heap of grain should be covered overnight with sacks soaked in the formalin solution, and the shovelling should be done very thoroughly so as to make sure that every grain is completely wetted by the solution. The steeping method as described is in general safer, both in regard to smut-control and in avoiding damage to the seed, and is at least as easy to carry out, provided a suitable dipping-trough is available.

FIG. 2. PORTION OF CEREAL SMUTS TRIAL PLOTS AT ASHBURTON EXPERIMENTAL FARM, SEASON 1926–27.

[*Photo by J. W. Hadfield.*

It will be noticed that the strength of formalin solution recommended has been increased from 1 pint in 40 gallons to 1 pint in 30 gallons. This year's experiments (Table 3) show that the increased strength is quite safe, and is more effective in controlling the smut.

SUMMARY OF EXPERIMENTAL RESULTS.

The experiments on the control of oat-smut were this year confined to the hot-water, bluestone, and formalin methods, last year's work having shown these to be the most effective. Six varieties of oats were used, five of which showed heavy smut-infection in the untreated controls, the sixth (Algerians) remaining clean throughout. A series of samples dipped for ten minutes in water held at temperatures from 121° F. to 141° F. showed that the germinative vigour of the seed was

Table 3.—Oat-smut Experiments at Ashburton Experimental Farm, Season 1926-27.

Sown, 16th-19th October, 1926; first count, 17th November, 1926; final count, 1st–5th February, 1927.

Treatment.	Garton.									Dun.									Algerian.								
	Percentage Germination.			Plants.			Heads.			Percentage Germination.			Plants.			Heads.			Percentage Germination.			Plants.			Heads.		
	In Field.									In Field.									In Field.								
	First Count.		Mature Plants.	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	First Count.		Mature Plants.	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	First Count.		Mature Plants.	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.
	%	Pr.								%	Pr.								%	Pr.							
Control	69·2	1·72	63·7	255	116	45·5	876	354	40·4	79·0	1·23	78·2	313	99	31·6	1621	441	27·2	93·0	0·98	85·7	343	0	0	1367	0	0
10/121	73·5	1·57	70·0	280	9	3·2	1018	29	2·8	87·7	0·94	86·5	346	13	3·7	1734	66	3·7	92·2	1·06	88·7	355	0	0	1557	0	0
10/123	75·2	1·76	72·7	291	1	0·3	1026	3	0·3	86·2	1·72	82·0	328	0	0	1661	0	0	92·5	0·95	87·2	349	0	0	1514	0	0
10/125	76·5	1·16	71·0	284	0	0	884	0	0	84·7	1·09	78·0	312	4	1·2	1640	20	1·2	90·7	0·97	87·0	348	0	0	1361	0	0
10/127	74·7	1·45	68·0	272	0	0	893	0	0	86·5	1·10	82·7	331	1	0·3	1771	8	0·4	91·2	1·32	85·2	341	0	0	1414	0	0
10/129	78·0	1·08	73·2	293	0	0	982	0	0	87·7	0·97	82·5	330	1	0·3	1750	5	0·3	88·2	1·06	89·5	358	0	0	1653	0	0
10/131	76·2	1·59	74·7	299	0	0	1145	0	0	91·2	0·72	86·5	346	0	0	1742	0	0	87·7	1·06	85·2	341	0	0	1593	0	0
10/133	74·2	1·72	70·5	282	0	0	1117	0	0	88·0	1·18	88·0	352	0	0	1945	0	0	86·7	1·06	83·0	332	0	0	1520	0	0
10/135	79·2	1·32	74·7	299	0	0	1162	0	0	91·5	1·16	89·5	358	0	0	1977	0	0	84·2	1·03	81·2	325	0	0	1592	0	0
10/137	76·7	1·19	73·0	292	0	0	1138	0	0	92·7	1·19	90·2	361	0	0	2238	0	0	82·5	1·21	81·5	326	0	0	1658	0	0
10/139	70·5	1·30	68·0	272	0	0	1075	0	0	87·0	1·13	86·0	344	0	0	2058	0	0	76·5	1·60	76·2	305	0	0	1543	0	0
10/141	58·0	1·57	55·0	220	0	0	1011	0	0	78·2	1·56	76·7	307	0	0	1988	0	0	71·5	1·46	74·2	297	0	0	1517	0	0
Control	74·0	1·97	71·5	286	140	48·9	1099	486	44·2	82·7	1·26	81·2	325	106	32·6	1917	525	27·3	88·0	0·93	82·5	330	0	0	1510	0	0
Bluestone 2% ..	58·5	1·78	60·0	240	3	1·2	804	4	0·5	54·7	1·40	73·7	295	8	2·7	1444	18	1·2	64·5	1·33	76·2	305	0	0	1160	0	0
Formalin 1–240 ..	82·7	0·68	76·0	304	1	0·3	1053	1	0·1	93·7	0·91	90·5	362	0	0	2003	0	0	93·5	0·78	85·7	343	0	0	1504	0	0
Formalin 1–320 ..	78·0	1·08	73·2	293	1	0·3	983	1	0·1	94·5	0·74	89·7	359	0	0	1931	0	0	93·5	0·95	87·5	350	0	0	1502	0	0
Formalin 1–480 ..	80·5	1·37	74·7	299	35	11·7	993	95	9·5	95·0	0·65	92·7	371	7	1·8	1983	25	1·2	91·0	1·10	88·0	352	0	0	1538	0	0
Control	70·7	1·06	65·2	261	123	47·1	931	389	41·7	86·0	0·93	84·5	338	89	26·3	1960	428	21·8	95·2	0·68	87·5	350	0	0	1531	0	0

Table 3.—Oat-smut Experiments at Ashburton Experimental Farm, Season 1926–27—continued.

Treatment.	Sparrowbill.									Black Supreme.									Providence.								
	Percentage Germination.			Plants.			Heads.			Percentage Germination.			Plants.			Heads.			Percentage Germination.			Plants.			Heads.		
	In Field.									In Field.									In Field.								
	First Count.		Mature Plants.	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	First Count.		Mature Plants.	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.	First Count.		Mature Plants.	Total.	Smutted.	Percentage smutted.	Total	Smutted.	Percentage smutted.
	%	Pe.								%	Pe.								%	Pe.							
Control	80·0	1·37	73·0	292	60	20·5	1052	162	15·4	88·5	0·85	84·7	339	80	23·6	882	156	17·7	78·7	1·72	71·2	285	66	23·1	806	151	18·7
10/121	84·7	1·34	76·5	306	3	1·0	989	8	0·8	90·7	0·97	87·5	350	7	2·0	856	16	1·9	90·5	0·98	85·0	340	4	1·2	813	9	1·1
10/123	88·7	1·26	80·2	321	0	0	972	0	0	90·0	0·70	85·7	343	2	0·6	815	4	0·5	89·2	0·94	85·5	342	5	1·4	749	11	1·4
10/125	90·2	0·80	80·5	322	1	0·3	950	4	0·4	90·2	1·00	84·0	336	1	0·3	873	2	0·2	91·2	1·12	84·0	336	2	0·6	782	4	0·5
10/127	88·7	1·09	81·5	326	0	0	976	0	0	90·2	0·87	82·0	328	0	0	908	0	0	86·7	0·80	80·0	320	0	0	803	0	0
10/129	89·2	1·17	83·5	334	0	0	1050	0	0	91·0	0·85	84·7	339	0	0	915	0	0	86·2	0·76	77·7	311	0	0	843	0	0
10/131	88·5	0·85	80·5	322	0	0	1012	0	0	87·0	0·70	80·2	321	0	0	840	0	0	84·0	0·89	77·7	311	0	0	853	0	0
10/133	89·5	0·93	83·0	332	0	0	959	0	0	87·2	1·03	81·2	325	0	0	869	0	0	85·2	1·56	77·2	309	0	0	814	0	0
10/135	87·5	1·30	78·5	314	0	0	891	0	0	86·0	1·21	80·5	322	0	0	879	0	0	84·7	0·87	76·5	306	0	0	801	0	0
10/137	82·5	1·16	76·7	307	0	0	944	0	0	86·0	1·57	85·0	340	0	0	965	0	0	87·0	1·37	80·7	323	0	0	811	0	0
10/139	59·5	1·46	57·0	228	0	0	767	0	0	81·7	1·56	78·5	314	0	0	879	0	0	84·0	0·80	80·5	322	0	0	882	0	0
10/141	40·0	1·54	38·5	155	0	0	629	0	0	78·0	1·44	75·2	301	0	0	855	0	0	74·0	1·65	72·7	291	0	0	818	0	0
Control	83·7	1·06	77·5	310	61	19·6	1004	156	15·5	90·7	1·09	89·2	357	145	40·6	928	277	29·8	79·5	1·75	75·2	301	66	21·9	919	183	19·9
Bluestone 2% ..	65·5	1·69	67·5	270	1	0·4	729	3	0·4	79·7	1·57	80·0	320	14	4·4	779	32	4·1	79·5	1·37	76·2	305	0	0	842	0	0
Formalin 1 240 .	94·5	0·85	83·0	332	0	0	967	0	0	89·2	1·09	84·5	338	0	0	864	0	0	87·0	1·21	82·3	331	0	0	1047	0	0
Formalin 1–320 .	93 0	0·78	88·5	354	1	0·3	1024	2	0·2	88·7	1·00	78·0	312	2	0·6	803	4	0·5	88·0	1·13	84·0	336	0	0	929	0	0
Formalin 1 480 ..	88·2	1·22	84·5	338	4	1·2	908	8	0·8	89·5	0·78	84·5	338	25	7·4	801	47	5·8	86·7	1·36	83·2	333	1	0·3	887	3	0·3
Control ..	87·5	1·02	83·2	333	60	18·0	899	137	15·2	88·5	1·28	79·2	317	131	41·3	789	287	36·3	77·7	1·51	74·7	299	85	28·4	980	239	24·2

not impaired up to 137°, and that only with the Sparrowbill sample was there a serious drop in germination at 141°. With the Garton seed (Abundance), which gave 47 per cent. of smut in the controls, no smut appeared at temperatures above 123°. The Sparrowbill, Black Supreme, and Providence varieties showed no smut above 125°, while the Duns gave one smutted plant at 127° and 129° F., but none above that temperature. A gradual increase in tallness of the plants at harvest was apparent in all varieties, as compared with the control rows, through 121° to 133°, this being maintained to 137°, and dropping off to control level again at 141°.

Bluestone (copper sulphate) showed satisfactory results only with the variety Providence, in which it controlled the smut, with a slight improvement in germination over controls. With the other varieties bluestone failed to control the smut, and it impaired the vigour of the seed, so that not only was the total germination less but it was delayed with many of the seeds for several weeks. In the tabular results it will be seen that bluestone alone showed a higher percentage count of mature plants than at the first count, when the majority of the plants were 3 in. to 4 in. high. In addition the bluestone rows looked sickly and yellow compared with the healthy green of the control and formalin rows alongside.

Three strengths of formalin solution were used: 1–240 (1 pint to 30 gallons), 1–320 (1 pint to 40 gallons), and 1–480 (1 pint to 60 gallons), in each of which the seed was dipped for ten minutes and drained, kept moist and covered overnight, and sown on the following day. No significant difference could be detected between the three treatments in regard to germinative vigour, and all three were in general better than the untreated controls. In regard to smut-control, the 1–240 strength completely controlled the smut, except in the Gartons, where one seed escaped disinfection. The 1–320 strength controlled the smut with Duns and Providence, but failed to do so in the other varieties, though the amount was reduced to less than 1 per cent. The 1–480 strength failed to control the smut in any of the varieties.

INTERNATIONAL CONGRESS OF AGRICULTURE, 1927.

THE thirteenth International Congress of Agriculture will be held at Rome from 23rd to 28th May this year. The programme of the congress is divided into six sections, as follows: (1) International Conference of Agricultural Associations; (2) Agricultural Cultivation and Industry; (3) Zootechnics; (4) Training and Co-operation in the Agricultural Industry; (5) Agricultural Geology and Climatology; (6) Women's Section, dealing with women's organizations in rural districts, domestic economy, and the development of rural life. The main topic for discussion in Section 3 will be the problem of the world production of meat and milk from an economic and social standpoint; and that in Section 2 the cultivation of cereals from a similar point of view.

Winton Experimental Farm Pasturage.—Referring to last month's article on top-dressing trials at Winton Experimental Farm, the weeds shown by botanical analysis to be present in the pasture of Block 3 (ranging from 6 to 8 per cent. of the herbage) were Scotch thistle, catsear, hawkweed, mouse-eared chickweed, and scarlet pimpernel. In the unlimed strips Yorkshire fog and sweet vernal were also present.

"NATURAL CONTROL" OF WEEDS AND INSECTS BY FUNGI.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

"NATURAL CONTROL" is a shibboleth that has been much before the public in recent years, owing to the amount of prominence it has been given in the Press. The possibility of eliminating a weed or insect without direct labour or monetary expenditure has an especial appeal to the farmer or orchardist. The writer has of late received increasing numbers of specimens of weeds, insects, and the like, sent in by farmers and others to the Laboratory for examination, which were supposed to be killed by some "natural enemy."

The possible value of fungi as controllants of weeds and insects has been held in view by the Department of Agriculture for many years; and since the writer commenced his duties as Mycologist in 1919 he has had to carry out much experimental and observational work in this connection. The present article brings together the results of this work.

FUNGI ATTACKING WEEDS.

Canadian Thistle (*Cnicus arvensis*).

A rust, *Puccinia obtegens*, which attacks this plant is perhaps one of the finest examples of the effects of control of any weed by a fungus. This organism has been present in New Zealand to the writer's knowledge for at least forty-six years (for specimens are in his herbarium collected in Canterbury in 1881 by T. Kirk), and is so widespread that it can be found in almost any clump of Canadian thistle. Once a patch becomes infected the disease persists for an indefinite period, and is noticeable for many years. One such clump of diseased thistle the writer noticed first in 1916, on the banks of the Turakina River, Wellington District, and on a visit this season it was found still to be infected. Once the rust becomes established it attacks a proportion of the plants, distorting them and so altering their colour as to render them conspicuous. Such plants fail to set seed (if female), as they usually succumb shortly after flowering. As has been mentioned, the disease is so widespread that scarcely a patch is free from it, whether in Auckland or Southland; yet Canadian thistle is spreading each year. The fact remains that only a proportion of the plants are infected, and although these are prevented from seeding, and usually killed, yet others in the clump reach maturity and produce more than sufficient seed necessary for perpetuation and spread.

The rust may be readily spread artificially; for all one has to do is to select a diseased stem, and, in the late spring during wet weather, thresh healthy plants with it. But even when this is carried out systematically, so that every individual plant in the patch is inoculated, at best not more than about 50 per cent. of the plants show signs of the disease the following season (for it is in the season after inoculation that the disease distorts the plants). This matter has been discussed more fully by A. H. Cockayne (1, 2).

A second disease of Canadian thistle has become noticeable in recent years in certain areas through the North Island. This kills and blackens numbers of stems in certain patches. The writer's attention was drawn to such areas in the Gisborne district in 1922. Specimens were secured, and from these cultures were made and a species of *Fusarium* isolated. This was inoculated into Canadian-thistle plants grown in pots in the Laboratory, and in the majority of cases these were blackened and killed within three weeks. Numerous cultures were prepared and taken to Plimmerton, where patches of Canadian thistle were growing in rich land. Seven of these patches were selected, and a number of plants in each inoculated. In practically all cases the inoculated plants were killed, so that hopes were entertained that a useful controllant of the weed had been secured. Inspection the following year revealed the fact that not one of the inoculated patches showed the presence of the disease. Nor has it shown up subsequently either in these areas or apparently (for it has not since been recorded) in those at Gisborne from which the original material was secured. Stock cultures had been kept, and when the disease did not appear in the inoculated patches further experiments were conducted in the Laboratory with plants in pots. All were uniformly negative, so that at the time the fungus was considered to have lost its pathogenicity through long keeping. Specimens of the same disease have been sent in subsequently on numerous occasions, but, in view of the facts recorded above, further experiments with it have not been conducted.

A third disease of Canadian thistle has occasionally appeared. This disease, caused by the fungus *Sclerotinia sclerotiorum*, is readily noticeable in that it attacks the stem of the plant above ground-level and there produces a canker. The plant is killed, and if the stem is cut open, in the cavity will be found numerous black, shot-like bodies termed sclerotia, which serve to carry the disease from one season to the next, and also to characterize it. This disease has been noted on other weeds, such as spear thistle (*Cnicus lanceolatus*), wing thistle (*Carduus pycnocephalus*), and fennel (*Foeniculum vulgare*), and has proved troublesome on many cultivated flowers, potatoes, tomatoes, peas, beans, Jerusalem artichokes (largely grown for pig-feed), and many others. The writer has records of its occurrence on forty hosts in New Zealand.

In view of the fact that it has proved a serious trouble of cultivated plants, it was considered inadvisable to experiment with this disease. Moreover, it is doubtful if it would prove of any value as a controllant of weeds, for, despite the prevalence of the fungus throughout New Zealand, it has been found but once on each of the four weeds here enumerated as hosts.

Broom (*Cytisus scoparius*).

For the past six years the writer has had under observation a gully near the Biological Laboratory in which there is a dense growth of broom. About 1 per cent. of these plants are dead or dying, and over this period the percentage has not appeared to vary. Examination has shown that the organism killing the plants is *Stereum purpureum*, the cause of silver-leaf of fruit-trees. This has proved one of the most serious diseases attacking fruit-trees in New Zealand (7, p. 284), and is

also often troublesome on poplar, willow, white-birch, oleander, laburnum, lilac, tagasaste, &c. In view of this fact it is surprising that it has done so little damage to the broom in the gully referred to, as conditions are ideal for widespread infection, the plants being very numerous and close, and stock constantly pass through this area, breaking down branches and affording the wounds necessary for entry of the parasite. This is not an isolated case, for, as has been recorded elsewhere (7, p. 292), thousands of infected broom-plants are to be seen on waste land in the Tasman and Mapua districts of Nelson.

Gorse (*Ulex europaeus*).

Very frequently dead gorse-plants may be noted growing among healthy ones, and dead plants of this type are among those most frequently sent to the Laboratory for examination and report. Up to the present only one fungus has been isolated from such material. The work was conducted by Mr. J. C. Neill, Field Mycologist, who inoculated with the organism isolated (the fungus was not identified) seedling gorse-plants grown in pots, but all experiments were negative. Gorse is mentioned here (it being so frequently forwarded for examination) so that in future those interested will recognize the fact that, despite many attempts, only one fungus, and that not pathogenic, has been isolated from it. A satisfactory explanation for the frequent death of these plants is not forthcoming. Frequently examination has shown borer to be responsible; in other cases the plants have been found infested with cottony cushion scale (*Icerya Purchasi*), a pest known to kill this and other plants on occasions; but many other specimens have been examined in which neither borer nor scale was present.

Blackberry (*Rubus fruticosus*).

Owing to its economic importance, careful observations during the past five years have been made of the fungi present on blackberry.

The most outstanding instance of fungous attack upon this host occurred in 1922, and formed the subject of an article by the writer (4). In this instance it was reported in the Press that large areas of blackberry (many hundreds of acres) had been killed outright in Auckland Province. Mr. L. Paynter and the writer made a survey of the Ngawaro, Oropi, Tauranga, Waihi, Te Aroha, and Morrinsville districts, in which the disease was reported to be prevalent. As is usual on such occasions, the areas when examined were found to be small, ranging in extent from a few yards to about an acre.

The organism causing the death of these plants was isolated and found to be *Leptosphaeria Coniothyrium*, the cause of cane-wilt of raspberry. Inoculation experiments showed that, although this disease had killed numbers of plants in the field, it did but slight damage to the plants artificially infected, at best killing a few canes, but generally merely forming lesions on the latter. The following year the disease did not appear to do any damage in those areas where it was prevalent the previous season; and from that date it has not been reported as being of any moment. It is abundant on blackberry throughout New Zealand.

A second disease noted on the survey tour in 1922, and commented on in the same article, was a fruit-rot caused by the fungus *Rhizopus arrhizus*. Under favourable conditions this organism destroys most of the fruiting panicles of a plant—indeed, in one instance it was found to have destroyed most panicles over a considerable area in a swamp at Inglewood, Taranaki. Mr. R. Waters, Officer in Charge of the Biological Laboratory, recently brought in numerous specimens of these infected fruiting panicles. They were handed to Mr. N. R. Foy, Seed Analyst, who found that approximately only 1 per cent. of the seed from such panicles had matured an embryo. Thus it is seen that this disease under favourable conditions may almost completely destroy the seed. Unfortunately, these conditions are not readily attained, for it has been proved experimentally that this fungus attacks only overripe fruit, or fruit which has been injured in some manner. Further, it is essentially an organism which usually thrives only where the atmospheric humidity is high.

A third disease of blackberry abundant in New Zealand is leaf-spot, caused by the fungus *Septoria Rubi*. This produces spots on the leaves, but appears to have little detrimental effect on the host, as it is abundant wherever this plant occurs.

A fourth disease is caused by the rust *Kuehneola albida*, also common in most localities on blackberry. It attacks leaves and stems, but, apart from stunting the plant somewhat, does little damage.

The possibility of introducing fungous diseases of blackberry and related species of *Rubus* from abroad with a view to utilizing them as controllants has also been considered. Letters were sent to approximately fifty mycologists throughout the world, requesting information relative to any disease on *Rubus* spp., and that where any of these showed promise of being actively parasitic specimens and cultures should be supplied. Most replied that—apart from such diseases as cane-wilt and leaf-spot, which were already present in New Zealand—no diseases of any significance were present; a few regretted their inability to supply material; and three forwarded specimens. Dr. Pethybridge, England, forwarded viable material of the rust *Phragmidium violaceum* on blackberry; Dr. B. O. Dodge, Washington, D.C., U.S.A., forwarded the rust *Gymnoconia Peckiana*; and Dr. A. Sharples, Straits Settlements, forwarded cultures of three fungi from *Rubus* spp. All inoculations—which have been carried out over a period of twelve months—proved negative, save with the cultures from Dr. Sharples, which have given inconclusive and unsatisfactory results.

Bracken Fern (*Pteridium esculentum*) and **Hard Fern** (*Paesia scaberula*).

In 1919 Mr. E. Bruce Levy, Agrostologist, brought the writer abundant material of bracken which had apparently been killed by some disease. Cultures were made and a species of *Fusarium* isolated. This was inoculated into bracken-plants kept in pots in the Laboratory, but with negative results. Further inoculations were made into plants growing on the edge of a roadside near Weraroa: these also were negative. It was thought that if inoculations were carried out in the locality where Mr. Levy obtained the material better results might be obtained; consequently cultures were taken to Marton and seventeen

plants inoculated. Of these at a later inspection five were found to be dead, and the *Fusarium* was again isolated from the killed rhizomes. The following season an examination of the areas was made, but no dead plants could be found, nor have such appeared since.

Specimens since received from correspondents have sometimes yielded this same *Fusarium*, but more frequently no fungus has been isolated. In view of the indifferent results secured, further experiments with the *Fusarium* have not been undertaken.

Several times in recent years Mr. Levy has brought to the Laboratory specimens of hard fern apparently killed by some disease. This plant grows in patches, and in the centres of these areas frequently occur numerous dead plants. Among these, grasses usually become successfully established. Consequently Mr. Levy thought the possibility of securing a pathogen to kill similar areas on the class of country on which he had been working at Whangamomona would prove of considerable value. Unfortunately, up to the present no fungus or bacterium has been isolated from this hard-fern material.

Goat's-rue (*Galega officinalis*).

In 1919 Mr. J. Fleming, Stock Inspector at Palmerston North, brought to the writer diseased specimens of goat's-rue, which he found to be not uncommon on the banks of the Manawatu River at Palmerston North. The stems had been attacked at ground-level and destroyed, with the result that the plants had been killed.

Isolations were made and a fungus, *Phoma Galegae*, isolated. Cultures inoculated into young plants in pots were positive, the latter being killed in three weeks. Inoculations in the field were undertaken in the vicinity of the bridge at Palmerston North. Owing to the fact that the writer moved very shortly afterwards to Weraroa, the results were not followed up, but inspection of the area made six months later showed a number of dead plants. The disease did not appear to have spread, however, for no recently infected plants were found. The disease has subsequently been noted on several occasions on the river-banks, isolated plants being affected; but in no instance can the disease be said to have proved instrumental in controlling the growth of goat's-rue in this region.

Tauhinu (*Cassinia leptophylla*).

In 1926 Mr. H. McDonald, Levin, reported to the Department of Agriculture that a disease appeared to be killing tauhinu on his property at Weraroa. The writer visited the area with Mr. McDonald and found a considerable number of dead and dying plants. Examination of infected plants showed they were being attacked by a wound parasite which penetrated through injuries formed as a result of the wind splitting branches at the crutches. Very many plants were examined, and on severely infected and dead plants numerous fructifications of one of the shelf-fungi were secured. These were sent to the Kew Herbarium for examination. Miss Wakefield, Mycologist at Kew, reported that the fungus resembled in general structure and spores resupinate forms of *Fomes ignarius*, but considered the colour of the flesh was not quite the same. No infection experiments with this

organism were undertaken, for the writer was informed that it was intended to use the organism commercially for the control of tauhinu.

Numerous other fungous diseases of weeds occur in New Zealand, but sufficient has been written to indicate that with our present knowledge it is not possible to destroy on a large scale any of the weeds listed by those fungi found attacking them. Sometimes in nature the severity of attack amounts to a local epidemic, but even were conditions governing such a severe attack known it is highly improbable that they could be artificially created over any extensive area.

FUNGI ATTACKING INSECTS.

Entomogenous fungi have been used for many years in the control of insects in the citrus-groves of Florida. Knowledge of this fact has led the writer to interest himself in this group.

Numerous instances of fungi attacking insects can be cited: For example, the well-known "vegetable caterpillars," which are not vegetables but larvæ of species of moths which have been parasitized by certain fungi; house-flies attached to a window-pane in the late autumn and surrounded by a "halo" of spores of the fungus *Empusa Muscae;* scale insects on leaves in the forest so altered as to be unrecognizable, &c.

One such fungus (*Cephalosporium Lecanii*) has been known for the past few years to attack the brown scale (*Saissetia oleae*) in citrus-groves in the Auckland District. In fact, in certain seasons this fungus has become so widespread that it has frequently been difficult to find a scale not parasitized. Naturally, orchardists have been impressed with its value as a controllant of brown scale, and many inquiries have been made as to the best method of propagating it.

More recently Mr. Everett, Orchard Instructor, has forwarded from Tauranga another species (*Sphaerostilbe aurianticola*) attacking red scale of citrus (*Chrysomphalus aurantii*). This organism also was abundant on all the scales on the specimen forwarded.

That such fungi should be used in the control of these scales seems practicable, and, as indicated, they are used for this purpose in Florida groves. Unfortunately, New Zealand experience has shown that they are unreliable, in that one season they may practically exterminate the scale in a locality, yet in the next may scarcely or not at all check the spread of these pests.

Experience elsewhere has been similar, for Mr. T. Petch (8), the world's authority to-day on this group of fungi, in a presidential address before the British Mycological Society in 1921, summarized the position as follows:—

> At the present day, after thirty years' trial, there is no instance of the successful control of any insect by means of fungous parasites. If entomogenous fungi already exist in a given area, practically no artificial method of increasing their efficacy is possible. If they are not present, good may result from their introduction if local conditions are favourable to their growth; but, on the other hand, their absence would appear to indicate unfavourable conditions. It would seem that a fungus makes little progress until the insects are excessively numerous, either locally or generally, when for reasons not known an epidemic of fungous disease breaks out. And in this connection it may be noted that the apparently successful experiments in inducing a more rapid dissemination of an entomogenous fungus have usually been made during such an epidemic . . . The problem

which has yet to be solved by those who wish to control insects by means of fungi is how to create an epidemic at a time when such an epidemic would not occur naturally. The evidence indicates that it is not possible to accomplish that by the mere introduction of the fungus or by spraying spores from material or artificial cultures. The solution of the problem probably depends in each case upon a study of the bionomics of the insect.

This statement, from one so well qualified to discuss the subject, shows that at present the grower would be well advised to ignore attempts at control of citrus scale by the use of entomogenous fungi, and to rely upon the sprays recommended for the purpose.

Vast numbers of larvæ of insects are destroyed annually by the so-called "vegetable caterpillars." These fungi parasitize and replace the tissues of their hosts with a compacted weft of mycelium. No less than six species are present in New Zealand (3, 5) — namely, *Isaria Sinclairii* (Berk.) T. Petch, on specimens of cicada, *Melampsalta cingulata* Fabr. and *M. cruentata* Fabr.; *Cordyceps Craigii* Lloyd, *C. consumpta* G. H. Cunn., and *C. Robertsii* Hook., on larvæ of *Porina* spp. (subterranean grass-caterpillars); *C. Aemonae* Lloyd, on the larvæ of *Aemona hirta* Fabr. (flat-headed lemon-tree borer); and *C. Kirkii* G. H. Cunn., on *Deinacrida rugosa* Buller (Stephen Island weta). Some of these fungi are rare, but others—*e.g.*, *Cordyceps Robertsii* (the common "vegetable caterpillar")—are abundant and collected in their hundreds in certain localities such as Mount Egmont and the Rotorua district.

Flies parasitized by a fungus, *Empusa Muscae*, are familiar to all in late autumn in dwellings, yet flies appear as abundant as ever the following season.

A fungus, a Phycomycete, species unknown, was in 1919 at Weraroa found to have almost exterminated the larvæ of diamond-back moth (*Plutella maculipennis*) attacking the swede crops on the Central Development Farm. This proved so promising that field observations over a period were carried out. On all the hundreds of leaves examined numerous larvæ were present, but in all cases these were found to be parasitized. The fungus was isolated by Mr. R. Waters, but, as living larvæ could not be obtained (so widespread had the parasite become), he was not able to carry out inoculation experiments. The following season observations made on the farm and in the district showed that, although the diamond-back moth was abundant, traces only of the parasite were present; nor has it been observed to be prevalent subsequently in any part of New Zealand, though examinations have been conducted each year.

In 1923 Mr. D. Miller, Entomologist, brought the writer numerous specimens of codlin-moth (*Cydia pomonella*) larvæ from Canterbury parasitized by a species of fungus. Only the *Isarial* form was present, and identification was thus not possible. So abundant was this parasite that Mr. Miller had difficulty in obtaining unaffected larvæ. Nevertheless codlin-moth was as troublesome as ever the following season.

These facts bring home forcibly the truth of Mr. Petch's remarks. We know so little at present regarding that balance between casual parasitism and extermination of any one host by its parasite that, until the conditions governing such can be worked out and controlled, control of insect pests by fungi must be regarded as possessing practically no value.

FUNGI ATTACKING FUNGI.

Even fungi have their parasites, as is well known by the very numerous examples which have been recorded at intervals in mycological literature. A few examples must here suffice. One frequently finds present in the uredosori of many of the rusts the fungus *Darluca filum*. This parasite destroys the uredospores, and also on occasion attacks in addition aecidiospores and teleutospores. So widespread is this parasite that we frequently have difficulty in securing specimens free from it. In a recent paper (6) the writer has recorded it as being found on no less than twenty-eight species, and it appears to be equally abundant throughout the world. It might be expected that such a parasite would be of material value in checking the spread of many of these rusts. Unfortunately, such is not the case, for examination of any rust pustule shows that as a rule a small proportion only of the spores have been destroyed, this number being usually in the vicinity of 1 per cent., and seldom more than 5 per cent.

Other parasites of a similar type have been noticed in New Zealand from time to time, such as *Cicinnobolus Cesatii*, on powdery-mildew of the apple; *Tuberculina persicinia*, on certain rusts; and a *Fusarium* (unidentified), on the uredosori of acacia gall-fungus (*Uromycladium notabile*). But in no instance have they proved of any value in checking the spread of these diseases.

CONCLUSION.

From the foregoing data, collected during the past eight years, dealing with numerous diseases of weeds and insects under varying climatic and soil conditions, only one conclusion can be drawn—namely, that with our present knowledge and technique it is not possible to use in the economic control of weeds and insects fungi which occasionally attack them under natural conditions. This is to be regretted, for such a method of control would have proved of inestimable value, especially in those areas and on those properties where the labour of eradication by hand is too costly.

The evidence produced indicates that it is but a waste of time to proceed with experiments along these lines. It also presents the fact that the Department of Agriculture has for many years given attention to the investigation of any such possible methods of weed or insect control.

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LIMING AND PHOSPHATE TOP-DRESSING EXPERIMENTS ON PASTURE IN CANTERBURY, 1924–25–26.

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IN the July, 1925, issue of the *Journal* the results of an experiment on the top-dressing of pasture on the farm of H. E. Peryman and Sons, Tai Tapu, were recorded and discussed. The paddock was sown down in September, 1923, with 30 lb. perennial rye-grass and 6 lb. white clover per acre. Phosphates in the form of superphosphate and basic super caused increases of about 1¼ tons of hay per acre, their application being highly profitable. As a result of the very large increases the questions which suggested themselves were: (1) Would the phosphates have any further effect in the following season? (2) Would a further application be justified? (3) How would the application in 1925 affect the control plots of the previous year?

To test these points the plots were crossed with ten replications of super and control plots. These strips were half a chain wide and alternated with each other. Hence, wherever a control of the 1925 season fell the treatments of the previous season remained. Where the super of 1925 crossed the manured plots of the previous season, phosphates had been applied for two successive seasons, and where the super of 1925 crossed a control of the previous season the effect of super applied in 1925 could be measured.

The manures used in the 1924–25 season were as follows, all weights being per acre: (1) Superphosphate (42–44), 2 cwt.; (2) superphosphate (42/44), 2 cwt., plus dried blood, ½ cwt.; (3) basic super (40/43), 2 cwt.; (4) basic super (40/43), 2 cwt., plus dried blood, ½ cwt. The blood caused no increase, and in measuring the effect of the manures in the second season both phosphate and phosphate-plus-blood plots were regarded as phosphate plots. It was assumed that the small amount of blood would have no effect in the second season after application. The 1925 application of 2 cwt. super per acre was made on 10th July, and the area visited on 15th October, when the effect of this treatment was apparent on account of the greater development on clover. The manured plots of 1924–25 were not distinguishable with certainty. Waterlogged patches were much in evidence, and on these there was practically no growth. The crop was cut and weighed on 14th December, and the weights recorded in Table 1 are of the green weight of material. About one-third of these would represent hay weights.

Comments on Table 1.

(1) Super, which caused the highly profitable increase of 1¼ tons of hay per acre in 1924, has given a further increase of over 1 ton of green material, equal to about ⅓ ton of hay, in the second season after application.

(2) Basic super has also caused a further increase.

(3) The application of super in 1925 to plots not previously treated (*i.e.*, controls of year 1924 plots) shows an increase in one crop of 2½ tons of green material, or about 16 cwt. of hay.

Table 1.

Area of individual weighed plot = $\frac{1}{248}$ acre.

Comparison A *versus* B.	Number of Paired Plots.	Green Weight in Tons per Acre.		Difference Significant or Non-significant.*
		Yield.	Difference in Favour of A.	
A. Super (applied 1924) ..	30	5·9	1·1	S.
B. Control	..	4·8	..	..
A. Basic super (applied 1924) ..	25	5·7	0·7	S.
B. Control	..	5·0	..	..
A. Super (applied 1925) ..	53	7·3	2·5	S.
B. Control	..	4·8	..	..
A. Manure, irrespective of kind (applied 1924), plus super (applied 1925)	121	7·3	1·7	S.
B. Manure (applied 1924) ..	..	5·6	..	..

* A difference is regarded as "significant" only when the chances are 30 to 1 or more in its favour.

(4) Although the manures of the first season's application were still having a beneficial effect on yield, the application of an additional 2 cwt. of super caused a further increase of 1·7 tons of green material (about 9 cwt. of hay). This must be regarded as highly profitable, as the margin of profit after charging the cost of super against the one crop is about 30s. per acre (hay at £5 per ton, super at 7s. per hundredweight).

The area was visited in July of the year, and the greater palatability of the phosphated plots was evident by the close grazing of these as compared with controls.

LIMING AND PHOSPHATE (SUPER) TOP-DRESSING.

With the object of acquiring information regarding the behaviour of lime alone, super alone, and lime plus super on as many types of soil as possible, a series of trials was commenced in 1924. Ground limestone (carbonate of lime) at the rate of 1 ton per acre, and superphosphate (42/44) at the rate of 2 cwt. per acre, were used. The arrangement of plots was as follows: (1) Lime (1 ton carbonate); (2) control; (3) superphosphate (42/44), 2 cwt. per acre; (4) lime, 1 ton, plus super, 2 cwt., per acre; (5) control; (6) lime; (7) super; (8) control; (9) lime plus super. This represents only half the number of plots used, so that it will be seen that there are four replications of each treatment and six replications of controls. The width of each plot is equal to from two to four widths of the machine used in top-dressing, varying, therefore, from about 16 ft. to 32 ft. on the different areas.

A number of weighings were taken from each strip, and weighings on treated plots compared with neighbouring weighings on controls. The material was weighed in the green state, and the percentage of hay found as described in the *Journal* for June, 1925 ("Pasture Top-dressing Experiment in Canterbury; Ward and Hudson").

1. Experiment on Farm of Mrs. Thomson, Spotswood.

Soil: Loam, showing a lime-requirement of about 2 tons per acre. (NOTE.—Where lime-requirement and type of soil are shown, these are taken from a report of the Department's Chemist on samples sent for examination.) Flat country at foot of downs.

History of paddock: Sown down in November, 1922, with 30 lb. perennial rye-grass and 5 lb. red clover. Lime applied, 4th June, 1924; super applied, 4th August. Hay crop weighed, 5th December.

Observations during growth: The plots receiving super were conspicuous by their greater development of red clover. No effect due to lime could be seen. In March, 1925, about three months after the hay crop was weighed, the area was stocked with sheep, which showed a marked partiality for the super plots.

Results of weighings are shown in the following table:—

Table 2.

Hay equals 33·5 per cent. of green weight. Area of individual weighed plot = $\frac{1}{264}$ acre.

Comparison A *versus* B.	Number of Paired Plots.	Hay in Tons per Acre.		Difference Significant or Non-significant.	Profit or Loss per Acre measured by Effect on First Crop of Hay (Hay £5 per Ton).
		Yield.	Difference in Favour of A.		
A. Lime ..	48	1·9	0·1	S.	Loss, 12s. 6d.
B. Control ..	..	1·8	..	..	
A. Super ..	48	2·2	0·5	S.	Profit, £1 16s.
B. Control ..	..	1·7	..	..	
A. Lime plus super	48	2·05	0·35	S.	
B. Control ..	..	1·7	..	..	

Comments on Table 2.

(1) The extremely small increase of 2 cwt. per acre due to lime is not profitable, and unless the lime has a considerably prolonged and increased beneficial effect its use in this case cannot be considered as being of great benefit. (The measurement of yields in 1926 — third season after application — shows that the lime has had a prolonged and increased effect. These results will be published as soon as possible.)

(2) The increase of ½ ton of hay brought about by the application of super is highly paying.

(3) The lime and super combination shows no better result than super alone; hence its application has reduced the profit from the super.

2. Farm of E. Ayrton, Domett.

Soil: Loam, very similar in situation to that of Experiment A, but rather wetter. Lime-requirement, 30 cwt. per acre. History of paddock: Sown down, 1918, with mixture of perennial rye-grass, crested dogstail, and red clover.

Lime applied, 10th June, 1924; super applied, at 300 lb. per acre, 26th August, 1924. Plots weighed on 3rd and 4th December. As far

as could be determined by observation, none of the treatments had any effect. The results of weighing are tabulated as follows:—

Table 3.

Hay = 32·2 per cent. of green weight. Area of individual weighed plot = $\frac{1}{117}$ acre.

Comparison A *versus* B.	Number of Paired Plots.	Hay in Tons per Acre.		Significant or Non-significant.
		Yield.	Difference in Favour of A.	
A. Lime	39	1·7	..	..
B. Control	..	1·7	..	..
A. Super	39	1·8	..	..
B. Control	..	1·8	..	..
A. Lime and super ..	39	1·85	0·08	S.
B. Control	..	1·77	..	..

Comments on Table 3.

(1) Neither lime nor super had the slightest effect on yield.

(2) Lime plus super gave the very small increase of just over 1½ cwt. of hay per acre. This area was extremely uniform, and in measurement of differences a high degree of precision was obtained.

It was hoped that the foregoing experiments could be followed up in the 1925 season, but the absence of feed in the spring and the small amount of subsequent growth prevented the farmers concerned from closing their paddocks for hay.

3. Farm of A. G. Harrison, Spotswood.

Soil: Loam; downs country, only two or three miles from location of Experiment 1. Lime-requirement, 2 tons per acre. History of paddock: Sown in 1921 with 40 lb. perennial rye-grass and 5 lb. mixed red and white clovers.

Lime applied, 4th June, 1924; super applied, 5th August, 1924. Cut and weighed, 12th December, 1924.

Observations during growth: All treated plots showed a marked increase in growth of white clover and suckling-clover. The lime-plus-super plots were particularly outstanding in this respect. On 12th March—three months after cutting for hay—the paddock was being stocked with sheep, and so much closer was the grazing on the lime and lime-plus-super plots that a distinct line of demarcation between these and their adjacent controls could be seen the whole length of the paddock, a matter of some 12 chains. All plots receiving lime had marked increase in white-clover growth. In a few places only was the effect of super alone apparent in this respect.

Determination of percentage hay: In view of the preponderance of the clovers on the lime and lime-plus-super plots, it seemed likely that the loss of moisture in drying would be greater on these than on the control plots; hence separate sets of samples were taken from control

and lime-plus-super plots. The percentages of hay, calculated as described in the June, 1925, *Journal*, resulted: Control, 30·7 per cent., and lime plus super, 22·6 per cent., of green weight. Consequently green weights of plots are shown in Table 4, and hay weights only for lime plus super and controls with which they are compared.

Table 4.

Area of individual weighed plot = $\frac{1}{25}$ acre.

Comparison A *versus* B.	Number of Paired Plots.	Green Weight in Tons per Acre.		Significant or Non-significant.
		Yield.	Difference in Favour of A.	
A. Lime	48	2·4	0·7	S.
B. Control	..	1·7	..	
A. Super	48	2·5	0·8	S.
B. Control	..	1·7	..	
A. Lime plus super ..	48	3·8	1·9	S.
B. Control	..	1·9	..	
Hay Weight.				
A. Lime plus super ..	48	0·86*	0·26	S.
B. Control	..	0·6†	..	

* 22·6 per cent. of green weight. † 30·7 per cent. of green weight.

Comments on Table 4.

All treatments have given highly significant increases, that of lime plus super being practically a 100-per-cent. increment in green weight. It will be seen from the lower part of the table that this represents only $\frac{1}{4}$ ton of hay, which at £5 per ton is worth only 25s., against which must be charged the cost of the lime and super, 36s. 6d. The continued effect of the lime and lime-plus-super treatments could leave no doubt in the mind of an observer as to their economical use. It seems practically certain also that the application of super alone was profitable.

Unfortunately, the wetness of the season prevented the hay which had been raked into rows from being carted, and the presence of the heaps produced such variation as to make it difficult to carry out further exact work. The effect of the lime on subsequent crops is being closely watched by Mr. Harrison.

4. Farm of A. McGiffert, Mina.

Soil: Loam. Downs country similar to that of Mr. Harrison (Experiment 3). Lime-requirement, 2½ tons per acre. History of paddock: Sown in October, 1920, with 20 lb. perennial rye-grass, 10 lb. Italian rye-grass, and 3 lb. red clover.

Lime applied, 5th July, 1924; super applied, early August, 1924. Crop weighed, 4th December, 1924.

Observations: The lime-plus-super plots were particularly outstanding on account of the clover-growth. Those having lime alone and

super alone were hardly distinguishable from the controls. On 12th March the area, then being closed up for the production of clover-seed, was visited. Both lime and lime-plus-super plots showed such a marked superiority in growth and amount of clover that it was estimated their yield would be about twice that of the controls. The super plots were not distinguishable from controls.

As with trials on Peryman Bros.' farm and Experiments 1 and 2, the plots of the first season were crossed in the following winter by alternating ½-chain-wide strips of super (2 cwt. per acre) and control. The super was applied on 23rd July, 1925, and the subsequent crop harvested on 18th December, 1925. The lime and lime-and-super plots were still outstanding on account of greater amount of growth, perennial rye-grass being the main constituent. The clover had almost disappeared. As far as could be observed the super alone was having no effect. The results for the two seasons (one crop in each) are shown in the following table:—

Table 5.

Comparison A *versus* B.	Season 1924 Crop. Hay = 31·8 per Cent. of Green Weight. Area of Individual Weighed Plot, $\frac{2}{15}$ Acre.				Season 1925 Crop. Hay = 45·2 per Cent. of Green Weight. Area of Individual Weighed Plot, $\frac{1}{80}$ Acre.			
	Number of Paired Plots.	Hay in Tons per Acre. Yield.	Difference in Favour of A.	Significant or Non-significant.	Number of Paired Plots.	Hay in Tons per Acre. Yield.	Difference in Favour of A.	Significant or Non-significant.
A. Lime ..	32	0·87	0·15	S.	25	0·65	0·15	S.
B. Control ..	..	0·72	..	..	..	0·50	..	..
A. Super ..	32	0·80	0·06	N.S.	26	0·57	0·03	N.S.
B. Control ..	..	0·74	..	..	..	0·54	..	..
A. Lime plus super	32	1·10	0·40	S.	26	0·80	0·35	S.
B. Control ..	..	0·70	..	..	..	0·45	..	..
A. Super applied 1925	..	..	..	..	78	0·60	0·10	S.
B. Control ..	..	..	..	..	..	0·50	..	..
A. Lime 1924 plus super 1925	..	..	..	..	54	0·70	0·10	S.
B. Lime 1924 ..	..	..	..	..	..	0·60	..	..
A. Lime plus super 1924 plus super 1925	..	..	..	..	53	0·86	0·05	N.S.
B. Lime plus super 1924	..	..	..	..	..	0·81	..	..
A. Super 1924 plus super 1925	..	..	..	..	54	0·65	0·06	S.
B. Super 1924 ..	..	..	..	..	..	0·59	..	..

Comments on Table 5.

In this case there can be no doubt regarding the validity of the claim that the increases shown in one crop represent only about one-half (or probably less) of the total benefit for the season. The weights indicate the lightness of the crop, which makes the fact of profitable increases from certain treatments the more striking.

(1) The increase due to lime of 3 cwt. of hay per acre in each of the two seasons indicates that its effect is likely to extend over a considerable period of time, and in spite of the general falling-off in yield in the second season there is no apparent diminution in the increase due to the treatment. If the increase shown is doubled it is evident that the profit shown would increase considerably, approaching the sum of £2 per acre for the two seasons. For example, if increase is 6 cwt. and worth £5 per ton the net profit would be 30s. less 22s. 6d., cost of lime per acre; hence the profit equals 7s. 6d. But if the increase is really 12 cwt. the profit would be £3 less 22s. 6d., or £1 17s. 6d. The application of lime to this type of land is undoubtedly payable.

(2) The extremely small increases due to the application of super are not significant, and even if significant could not be regarded as being very profitable.

(3) The combination of lime and super gives results which leave no doubt as to their value, and to get good results from phosphatic treatment it would appear that on this land it must be applied to limed ground. The profit as measured by the increases shown in the table is about £1 7s. 6d. per acre.

(4) The super which was applied in 1925 shows a small significant increase of 2 cwt. per acre. This in itself is barely payable, but if the fertilizer is of further benefit a small profit should result.

(5) The marked benefit derived from the lime-and-super combination, as shown, would lead to the expectation of a greater increase than 2 cwt. of hay per acre, brought about by the application of super in 1925 to those plots limed in 1924. The super has done no better than when applied to the controls of 1924, and the statement in comment 3 would appear incorrect. The apparent discrepancies are difficult to explain, but *may* be due to the fact that in the 1924 season super was applied to newly limed ground, while by 1925 the lime had been on the ground for just over a year.

(6) Super applied in 1925 to plots receiving lime and super in 1924 gave only a small statistically insignificant increase of 1 cwt. of hay per acre. The chances as calculated (20 to 1) approach accepted certainty, but the increase, if a real one, is not sufficient to warrant the application of the second lot of super.

(7) Super applied in 1925 to these plots receiving super in 1924 shows a significant increase of just over 1 cwt. of hay. The doubling of this increase does not give sufficient to make the application profitable.

Experiments 1, 2, 3, and 4 were conducted in the Cheviot district, being on an approximately straight line of ten miles from Domett to Spotswood. An excellent illustration of the diversity of results occurring over a comparatively small range of country is provided. Only from a large amount of data can generalizations be made.

5. Farm of F. W. Carpenter, Prebbleton.

Soil: Silty loam; lime-requirement, 3·2 tons per acre; flat plains land, fairly representative of medium-class wheatgrowing country. History of paddock: Sown in wheat in spring of 1921 with 20 lb. perennial rye-grass and 5 lb. red clover. The experiment was commenced in 1924, being similar in lay-out to Nos. 1 to 4, and was crossed in 1925 with alternating ½-chain strips of super and control.

Lime applied, 17th June, 1924; super applied, 11th August, 1924. In the first season two crops were weighed, the first on 8th December, 1924, the second on 19th February, 1925. The application of super across the plots of the first season was made on 9th July, 1925, and one crop harvested on 17th December.

Observations during growth: Only in the early spring of the first season could differences be detected. A very slight superiority of the red-clover growth was apparent on all treated plots. The results for the first season are shown in Table 6, and those for the second season in Table 7.

Table 6.

Area of individual weighed plot = $\frac{1}{147}$ acre.

Comparison A *versus* B.	First Crop, 1924–25 Season. (Hay = 33·7 per Cent. of Green Weight.)				Second Crop, 1924–25 Season. (Hay = 29·5 per Cent. of Green Weight.			
	Number of Paired Plots.	Hay in Tons per Acre. Yield.	Hay in Tons per Acre. Difference in Favour of A.	Significant or Non-significant.	Number of Paired Plots.	Hay in Tons per Acre. Yield.	Hay in Tons per Acre. Difference in Favour of A.	Significant or Non-significant.
A. Lime ..	48	1·4	0·1	S.	45	0·80	0·05	N.S.
B. Control ..	..	1·3	..	..	..	0·75	..	..
A. Super ..	48	1·4	0·1	S.	46	0·75	0·03	N.S.
B. Control ..	..	1·3	..	..	..	0·72	..	..
A. Lime plus super	48	1·6	0·2	S.	48	0·81	0·07	S.
B. Control ..	..	1·4	..	..	..	0·74	..	..

Comments on Table 6.

(1) Lime in the first crop of the growing season following application caused a slight but certain increase of 2 cwt. of hay per acre. No statistically significant difference between lime and control occurred in the second crop.

(2) Super gave an increase equal to that of the lime in the first crop, but no appreciable effect in the second.

(3) Lime and super showed a certain increase of 4 cwt. in the first crop and nearly 1½ cwt. in the second (see further discussion after Table 7).

Table 7 (One Crop, 1925–26 Season).

Hay = 36·49 per cent. of green weight. Area of individual weighed plot = $\frac{1}{160}$ acre.

Comparison A *versus* B.	Number of Paired Plots.	Hay in Tons per Acre.		Significant or Non-significant.
		Yield.	Difference in Favour of A.	
A. Lime applied 1924	20	0·87	0·24	S.
B. Control	..	0·63	..	..
A. Super 1924	20	0·71	0·06	N.S.
B. Control	..	0·65	..	..
A. Lime plus super 1924 ..	20	0·93	0·25	S.
B. Control	..	0·68	..	..
A. Super 1925	30	0·66	0·02	N.S.
B. Control	..	0·64	..	..
A. Lime 1924 plus super 1925 ..	36	0·90	0·04	N.S.
B. Lime 1924	..	0·86	..	..
A. Super 1924 plus super 1925 ..	36	0·69	..	..
B. Super 1924	..	0·69	..	..
A. Lime plus super 1924 plus super 1925	36	0·96	0·04	N.S.
B. Lime plus super 1924 ..	..	0·92	..	..

Comments on Table 7.

The first hay crop from which weighings were taken in the 1925 season was considerably lighter than the corresponding crop of the previous season.

(1) Lime shows an increase of about $\frac{1}{4}$ ton of hay. This, coupled with the effect of the lime in the previous year, shows a total increase of 0·34 or practically $\frac{1}{3}$ ton per acre. At £5 per ton this increase is worth approximately £1 13s., and after deducting the cost of lime (22s. 6d. per ton) a profit of 10s. 6d. per acre is shown. It is interesting to note that the increase in the second season is greater than that of the first, and it seems reasonable to suppose that continued benefit is likely to be derived from the lime. Hence a considerable financial benefit is expected.

(2) Superphosphate applied in 1924 does not show any significant increase in the 1925 hay crop. The certain increase in the first crop of 1924 is one of only 2 cwt. per acre. The super has not proved definitely profitable.

(3) Lime plus super of 1924 application shows a further beneficial effect to the extent of $\frac{1}{4}$ ton of hay in the 1925–26 season. Added to the increase shown in Table 6 of 0·2 plus 0·07, the total increase is just over $\frac{1}{2}$ ton. If this is worth £2 10s., the profit resulting is this amount less about 36s. 6d. for lime and super, the net amount being 13s. 6d. Hence the lime-and-super application has been a little more profitable than lime alone. The same remarks regarding further effect as applied to lime will hold also in this case

(4) The application of super in 1925 to (*a*) previously untreated ground, (*b*) previously limed ground, (*c*) previously super-treated ground, and (*d*) previously lime-and-super-treated ground has in no case shown a significant increase in the first hay crop taken after application.

6. Farm of J. H. Tobeck, Tai Tapu.

Soil: Rich silty loam, situated about half a mile from the area on which Peryman Bros.' experiment was conducted. Evidence already obtained leaves no doubt regarding the value of phosphates in this locality, but no information regarding the behaviour of lime was available. Consequently an experiment similar to those already described was conducted on this farm, some ten replications of treated plots being made.

History of paddock: Sown in 1919 with Italian rye-grass and red clover. A hay crop and one of red clover for seed have been taken off the paddock each year since sowing down.

In the spring of 1924 the whole of the paddock was top-dressed by Mr. Tobeck with 2 cwt. of super per acre, with most excellent results. For the experiment here recorded, lime (carbonate) was applied on 20th July at the rate of 25 cwt., and super at 2½ cwt. per acre on 17th July, 1925. The crop was cut and weighed on 10th December, 1925.

Observations during growth: No beneficial effects due to the treatment were apparent prior to the cutting of the crop. On 7th July, 1926, the area was inspected, and most of the super and lime-plus-super plots were distinguishable throughout their length owing to their being more closely grazed than the lime and control plots. As the lime plots did not differ from the controls in this respect the effect on palatability must be attributed to the super. The results of weighing of the one crop are as under:—

Table 8.

Hay = 29·2 per cent. of green weight. Area of individual weighed plot = $\frac{1}{81\pi}$ acre.

Comparison A *versus* B.	Number of Paired Plots.	Hay in Tons per Acre.		Significant or Non-significant.
		Yield.	Difference in Favour of A.	
A. Control	53	2·50	0·05	N.S.
B. Lime	..	2·45	..	..
A. Super	61	2·80	0·30	S.
B. Control	..	2·50	..	..
A. Lime plus super	60	2·70	0·17	S.
B. Control	..	2·53	..	..

Comments on Table 8.

(1) Lime has had no effect on the amount produced in the first crop of hay.

(2) Superphosphate, although applied to ground similarly treated in the previous season, has given a sufficient increase in the first crop to leave a profit of 12s. 6d. per acre.

(3) The lime-plus-super application has not been profitable. The increase shown must be attributed to the super, and is just sufficient in the one crop to pay for this treatment. Arrangements were made to follow up the effect of the treatment in the following season.

General Conclusions.

(1) It is evident from a perusal of the foregoing notes that the application of superphosphate as a top-dressing for pastures in the districts covered is not always profitable. In the main the better types of soil give the best response.

(2) Lime has given very varied results as measured by the effect in the season of application. Although those soils treated for lime-requirement were all lacking in this substance, the response to application seems to have very little relationship to the requirement indicated. However, on account of the length of time over which the effect of a dressing of 1 ton carbonate of lime per acre should extend, it would be unwise to draw definite conclusions. Further, the amount of data so far collected is extremely small, and with such diversity of result as that experienced in the Cheviot district alone it is evident that much work in a great number of places is required before generalization can be made.

(3) Where lime *has* proved beneficial the addition of superphosphate has further increased the return when applied in the same season as the lime.

(4) It must be borne in mind that the increases in weight of hay do not represent the full benefit derived from a treatment. The effect on the nutritive value of a pasture must be considerable. Further, where only one crop of hay is weighed in a season it seems reasonable to suppose that this crop, taken after the maximum growing-period of from twelve to sixteen weeks, represents not more than half the total growth for the year. Hence any increase resulting during the greater part of the year would be clear profit in addition to any already shown.

Thanks are due to the farmers mentioned for placing paddocks at our disposal and co-operating whole-heartedly in the work. Mr. F. E. Ward (now Director of Agriculture, Tasmania) was associated with the writer in the work, particularly that of the 1924–25 season, and his valuable collaboration is here acknowledged.

Subterranean-clover seed has been saved in the Marlborough district this season. Mr. F. W. Greenwood, Instructor in Agriculture, Blenheim, states that heretofore the difficulty has been not so much in harvesting as in shelling, so much soil being present with the harvested seeds and stems. It has now been found that autumn and spring harrowing combined with top-dressing enable the plant to assume a more erect habit, so that the seed-head in most cases is not buried in the earth, but seeds in the shade and protection of the foliage above it.

Among other causes of cotty wool is a sudden change in the weather from sultry heat to wintry conditions, such as sometimes occurs in spring. The more open the character of the wool the greater the effect of these climatic vagaries.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. CLOSING LIST FOR CALENDAR YEAR 1926.

Dairy Division.

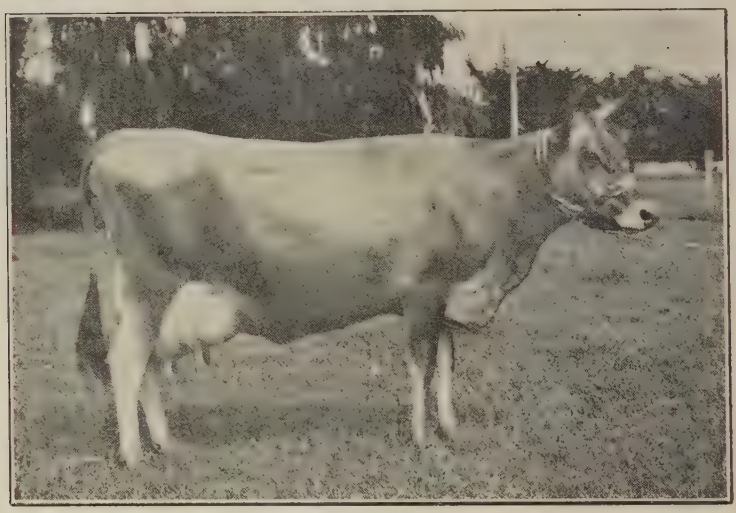
THE appended list completes the publication of records for purebred dairy cows which gained certificates in 1926.

The outstanding performance appearing ir the list is that of the Jersey senior two-year-old Prie-dieu, with 734·62 lb. of butterfat, tested by Mr. A. E. Watkin, of Takanini. Prie-dieu's sire is Peep's Gay Boy, and her dam Pride's Waitui. Her present record places her in the position of runner-up for the Jersey senior two-year-old class-leadership to the end of 1926.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Beechlands Ladylike	A. Moreland and Son, Te Rapa	2 10	241·5	365	8,597·1	455·49
Makanui Molly ..	H. G. Livingston, Kiwitea..	2 4	240·9	336	5,625·1	344·33
Green Part Pet ..	H. E. Walters, Waitoa ..	1 335	240·5	291	5,995·7	331·52
Sorceress	Nicholas Bros., Mangatoki	1 358	240·5	365	5,027·4	302·73
Green Park Tiny ..	H. E. Walters, Waitoa ..	1 268	240·5	266	5,166·0	272·86
Senior Two-year-old.						
Prie-dieu	A. E. Watkin, Takanini ..	2 308	271·3	365	14,982·7	734·62
Marshlands Best ..	A. E. Watkin, Takanini ..	2 334	273·9	334	9,723·6	485·34
Jersey Brae Graceful	Martin and Murray, Temuka	2 305	271·0	365	8,754·9	452·90
Three-year-old.						
Thornlea Royal Rose*	G. E. Yelchich, Waiuku ..	3 89	285·9	365	12,392·0	581·38
Marshland's Fern's Eminent	Martin and Murray, Temuka	3 54	282·4	342	11,190·8	563·19
Adare Lady Clare ..	J. A. Kurth, New Plymouth	3 325	309·5	359	10,103·1	537·54
Penybryn Cream ..	Banks and Son, Kiwitea ..	3 359	312·9	364	8,733·7	484·95
Arthingworth Renata	E. Smallbone, Richmond ..	3 345	311·5	365	7,790·4	401·43
Wichenford Anemone	F. I. Washbourn, Timaru ..	3 361	313·1	365	6,283·0	320·62
Four-year-old.						
Springvale Fair Lady	G. E. Cowling, Manaia ..	4 335	347·0	321	8,798·3	433·12
Bilberry's Bright Eyes	C. P. Crowley, Kaponga ..	4 342	347·7	289	7,699·5	390·30
Mature.						
Collingwood's Angel	E. Hellyer, Dunedin ..	6 224	350·0	365	12,527·8	764·34
Mystery's Golden Girl	A. E. Watkin, Takanini ..	7 119	350·0	365	12,024·3	679·75
Fox's Freda ..	H. E. Walters, Waitoa ..	10 25	350·0	341	10,963·5	615·71
Lala's Devotion ..	John Hale, New Plymouth	8 287	350·0	365	9,682·0	513·44
Cowling's Maid ..	G. E. Cowling, Manaia ..	7 360	350·0	315	8,874·9	493·90
Miro's Lass ..	J. A. Kurth, New Plymouth	7 2	350·0	365	6,296·8	427·04
Glorified Princess ..	F. I. Washbourn, Timaru ..	7 14	350·0	365	6,231·0	405·69



ALFALFA SUPREMACY (A. A. WAGSTAFF, WAIHOU).

C.O.R., 1926, in Jersey junior two-year-old class: 10,292·3 lb. milk, 650·37 lb. butterfat. Test commenced at age of 1 year 281 days.

NA RIWI MERCENA (H. W. REEVE, WAITOA).

C.O.R., 1926, in Friesian junior two-year-old class: 16,945·2 lb. milk, 685·5 lb. butterfat. Age at commencement of test, 2 years 84 days.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Totara K.P. Polkadot*	Piri Land Co., Auckland ..	2 143	254·8	365	12,709·4	487·13
Hobson Sunflower Segis	Hobson Farm, Ltd., Auckland	2 35	244·0	241	11,111·4	371·11
Tikorangi Nazli No. 1	Bevan Estate, Manakau ..	1 317	240·5	209	7,500·5	286·73
Tikorangi Manor Beets No. 1	Bevan Estate, Manakau ..	2 8	241·3	312	7,897·9	274·72
Tikorangi Woodcrest Rag Apple No. 1	Bevan Estate, Manakau ..	2 4	240·9	285	6,675·3	266·16
Hobson Pontiac Ormsby	Hobson Farm, Ltd., Auckland	1 350	240·5	190	6,640·7	262·18
Tikorangi Domino No. 1	Bevan Estate, Manakau ..	2 16	242·1	307	6,687·9	257·21
Tikorangi Diamond No. 1	Bevan Estate, Manakau ..	1 364	240·5	313	7,341·2	240·81
Senior Three-year-old.						
Rosevale Jewel Sylvia*	North and Sons, Omimi ..	3 323	309·3	365	17,376·6	584·61
Grahamholm Lady May Ormsby	Hobson Farm, Ltd., Auckland	3 234	300·4	208	10,081·7	340·31
Junior Four-year-old.						
Glen Iris Maori Maiden	O. A. Cadwallader, Greytown	4 7	314·2	365	19,626·7	687·67
Rosevale Princess Midget Posch*	North and Sons, Omimi ..	4 19	315·4	365	19,351·7	593·75
Senior Four-year-old.						
Rosevale Helena Posch*	North and Sons, Omimi ..	4 322	345·7	365	22,694·6	728·06
Mature.						
Peria Claudia 1st* ..	A. Thirlwall, Matamata ..	6 14	350·0	332	16,147·4	662·57
Rosevale Princess Lassie*	North and Sons, Omimi ..	6 85	350·0	365	16,556·2	632·73
Viola Beauty Burke*	J. J. Walker, Ohangai ..	9 126	350·0	328	19,615·9	582·35
Nepean Countess Alcartra Pietje*	J. J. Walker, Ohangai ..	5 324	350·0	351	15,520·6	519·29
Carlowrie Auroa ..	R. K. Macdonald, Edendale	5 26	350·0	365	13,390·4	389·59
	MILKING SHORTHORNS.					
Mature.						
Peach Grove Lady Dinah 2nd	W. J. Slack, Otaki Railway	7–8	350·0	332	14,551·6	571·26
	RED POLLS.					
Two-year-old.						
Tutamai Retourne ..	B. W. Harvey, Waverley..	2 322	272·7	320	6,900·5	301·36
Four-year-old.						
Susie Ann	B. W. Harvey, Waverley ..	4 65	320·0	354	11,109·3	448·48
Mature.						
June	B. W. Harvey, Waverley ..	5 354	350·0	282	8,985·8	372·82
Star 1st	B. W. Harvey, Waverley ..	7 30	350·0	327	10,205·0	363·33

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

Second-class Certificates.

Jerseys.

		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Vive La Clare ..	H. C. Sampson, Hillsborough	1 298	240·5	365	7,956·1	452·22
Makanui Silver Coin..	H. G. Livingston, Kiwitea	2 28	243·3	365	7,182·7	419·97
Wichenford Morning Light	F. I. Washbourn, Timaru ..	1 206	240·5	365	5,855·7	273·45
Mature.						
Fern Grove Lady Beatrice	H. C. Sampson, Hillsborough	9 9	350·0	365	13,796·3	688·04

SILO AT PUKEORA SANATORIUM FARM.

During the past season a good practical form of silo was constructed at the Health Department's Pukeora Sanatorium Farm, near Waipukurau, Hawke's Bay. The silo, a good idea of which is afforded by the photo, consists of ten stout posts, 10 ft. 6 in. long (standing 6 ft. 6 in. out of the ground), between which are built up 4 in. by 2 in. totara battens 5 ft. long, held loosely in a groove shaped on the posts. The structure, which has an inside diameter of 17 ft., is bound round at the top by a ½ in. wire rope, 55 ft. long, fitted with tightening-means. The ensilage material is weighted with earth, as in the stack method. For access to the ensilage, when required for feeding out, one post and the battens at that point are removed, this giving an opening of 10 ft. A minimum of waste is ensured as compared with the stack system. The fodder ensiled this season was part of the production of a fine stand of lucerne, the material being brought to the silo by horse-sweeps and elevated as shown.

SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT.

YOUNG pasture should be very carefully treated during winter, and never fed closely. Wherever possible the first grazing should be with sheep, and a time chosen when the ground is not wet. Neglect of these simple precautions is responsible in many cases for the short life of newly sown grass.

Older pastures should be well harrowed with the tripods whenever opportunity offers during the next two or three months. The operation is best done after rain, when the stock-droppings are soft. In pasture-management harrowing is probably next in importance to top-dressing, and hence, incidentally, the importance of stumping old bush land as time permits during winter. The action of the tripods stimulates the roots of the plants, tears out moss, and breaks away the dead and decaying matter, allowing both sun and air to penetrate the surface soil, all of which is so necessary in developing a vigorous growth of useful pasture elements. The large proportion of inferior grasses, such as Yorkshire fog, often seen in old pastures is largely due to the fact that the droppings have not been spread. This results in the killing-out of the better grasses, and round the edge of the droppings fog soon appears and flourishes.

Top-dressing was dealt with last month, and the work then suggested should be pushed on while weather conditions are good. The same applies to liming. In applying lime it is not always necessary to make heavy dressings. Generally the most profitable procedure is to apply from 6 cwt. to 15 cwt. of carbonate of lime, or half this weight of burnt lime, and repeat again in a year or two. Of course, if the land is very sour it will be necessary to apply a heavy dressing at once to correct this condition.

It is advisable generally to commence manurial top-dressing while the pasture is still in good condition. If it is markedly deficient in clovers and contains much weed-growth it may be better to break up and establish anew. Such a course applies specially to arable land under Canterbury or similar conditions.

Yard manure saved round cow-sheds and stables during the season, and not required for other crops, should be carted out and spread over weak pasture.

SEED POTATOES.

Potato-growers should be busy now selecting seed from the main crop for next season's use. The crop should be looked over before being dug, and the seed tubers taken from selected plants. This seed should be carefully stored. If special seed-rows have not been kept, the grower should have rogued several rows. Failing this, he should prepare for next season's seed-rows by the following suggested method: Before the tops have fully died down go through several rows and pick out what are considered to be healthy and true-to-type plants. Mark these, and later dig them and select the seed. This seed should be carefully stored and used next season on three or four distinct seed-rows.

The amount of seed produced from these rows should be sufficient to plant a fairly large area in the following season with seed fairly true to type.

LUCERNE.

During the coming month lucerne stands should be limed if necessary and, if dry enough, grubbed. Land that is being prepared for lucerne should be thoroughly limed before the end of June. Where a seed crop is required next season the stand should at this period receive a top-dressing of superphosphate, or, on the colder and wetter soils, super and blood-and-bone or any manure providing both nitrogen and phosphate. The periodical liming of lucerne stands is an important factor in prolonging their life.

CROPS AND TILLAGE.

No opportunity should be lost during the next few weeks of turning over any land still required for spring sowing. For such crops as mangolds, carrots, and potatoes autumn or early winter ploughing is most important. In the case of lea land, as long as the weather is fair the plough can be kept going; it requires a considerable rainfall to make such land too wet. Where old pastures are to be broken up, skim-ploughing in the autumn or early winter, followed by disking, especially on the heavier soils, as a preparation for the deeper spring ploughing, is a good insurance against dry summer conditions, besides allowing frost and sunshine to break up the soil and make fresh plant-food available.

In the North, renovation of old sod-bound paspalum areas by ploughing in narrow furrows is best carried out in late autumn.

Wheat-growers in Canterbury and North Otago will be particularly occupied with sowing operations during May. Interested readers may be referred back to some special notes on wheat-growing which appeared in the *Journal* for April of last year, pages 270–71.

WINTER FODDERS AND STOCK.

The feeding of supplementary winter fodders should not be neglected even when the dairy herd is drying off. Where swedes are grown they may be relied upon, together with a reasonable ration of hay. Care should be taken not to feed too many swedes to breeding-ewes in the early stages of pregnancy. Where roots are grown on heavy clay land they should be pulled and fed out as far as possible on the poorer parts of adjoining pastures; thus, while improving the latter, the soil-texture of the field in crop is not spoiled by puddling. Should roots or other fodder crops be fed off, stock must have access to adjacent pasture, and be kept off the crop entirely during wet weather if they are to remain healthy and the crop is to be fed at maximum profit. Where swedes or turnips are being fed off on the ground the shells should be grubbed up with the cultivator, provided the weather is dry.

Mangolds should be sufficiently ripened during May in a normal season to be pulled and clamped. If this cannot be done, and it is intended to leave the crop in the ground, the roots should be pulled or harrowed out in sufficient quantity to keep at least three weeks in advance of feeding. Neglect to observe this precaution is still responsible for trouble, especially in dairy cows; it likewise causes purging in sheep. Where conditions are suitable and the necessary cultivation

is given, the mangold crop is one of the most profitable, but must not be carelessly fed. In localities where frosts are severe the roots are better pulled and clamped rather than left in the field.

Lambs should never be in low condition when turned on rape or other green fodders, otherwise loss may occur. It is always wise to keep them on good, clean, fresh pasture for a time, while gradually allowing their digestive organs to become used to the change of diet.

Great care should be taken to see that dry dairy cows are fed to their fullest during the resting-period. Many farmers are still under the impression that when a cow is dry she can do with less food. This is a great mistake; it is during this resting-period that the cow should be built up if she is to give a good return in the ensuing season. Further, it should be remembered that during this period the cow is carrying a big calf. Careful experiments have shown that the better a cow is fed for a month or two before calving the better her returns will be when she comes in. There is no need to fear that a cow will be too fat at calving-time.

FEEDING OUT ENSILAGE.

Ensilage made by the stack method can be fed to stock as soon as the temperature is even in the stack and the latter has settled. This should be in about two months. A well-made stack, however, will continue to improve for a considerable period. When opening up the stack commence at one end by dividing it into three sections and taking out a corresponding cut—say, from 5 ft. to 6 ft. square. Throw the weighting-material from the first section back into the trench from whence it was taken (if earth is the weighting-material used). The ensilage may then be cut with a sharp spade or hay-knife. It should be well shaken up when being forked on to the dray, so that stock may get a fair sample and be encouraged to take it readily.

The hillside silo is filled from the upper and emptied from the lower side, the let-in sliding-boards forming the door on the front side being taken out as the surface of the ensilage falls with removal of the material.

In the case of permanent tower silos the ensilage must be taken from the top, not the bottom. For feeding to the stock a sufficient layer should be taken off evenly morning and evening. If the ensilage is of chaffed material it may be fed in boxes or troughs; if not, it can be distributed over the paddock similarly to stack ensilage.

A cubic foot of chaffed ensilage should weigh about 40 lb., which would be sufficient for a day's ration for the average cow (20 lb. morning and evening) in addition to what grazing she may obtain in the fields. A ton of ensilage will feed forty-four head of large cattle, or about four hundred and fifty sheep, for one day. Ensilage should not be overfed to stock, as it has a loosening tendency. For correcting this, if necessary, $\frac{1}{4}$ lb. precipitated chalk added to every 100 lb. of ensilage has been found effective. Only as much ensilage as is required each day should be fed out. It decomposes easily on exposure to the air, and then becomes dangerous as a food.

As with roots, it is good practice to feed out on the poorest paddocks, in order to build up fertility. The ensilage should be spread over the ground so as to get good results evenly, besides obviating the ill effects of poaching.

GENERAL REPAIRS.

Late autumn is a good period for effecting general repairs on the farm, such as to fences, gates, cow-sheds, and creek-crossings. On dairy farms these crossings should receive early attention. If this is done before the really wet weather sets in a great deal of extra work and worry will be avoided in the spring.

—*Fields Division.*

THE ORCHARD.

HARVESTING AND STORAGE OF FRUIT.

PICKING, packing, and marketing will still be engaging the attention of the apple and pear growers. Every care should be exercised in the handling of the fruit, so as to avoid the damage and deterioration which is caused through rough handling and lack of judgment in the picking. At this time of the year the fruit is frequently wet with rain or dews, and as far as is practicable it should not be gathered until perfectly dry. This point is more important in respect to fruit which it is intended to store for a time. Only sound mature fruit should be placed in storage. Growers who have mid-season varieties stored in their sheds should examine the fruit at frequent intervals, and if it shows any indications of going off no time should be lost in placing it on the market. Fruit which should be marketed at once is frequently held until it has gone off considerably before being sent away. As a result of its condition, in conjunction with the handling, the fruit often arrives at the market in a wasty and almost unsaleable condition.

Such late maturing varieties as Statesman, Rome Beauty, Newtown Pippin, Sturmer, &c., which are firm-fleshed, will with proper treatment keep longer than mid-season varieties. In consideration of this, in the main, varieties of this class should be given preference in the matter of cold storage. A cool, even temperature should be maintained, moderately dry, but not sufficiently dry to cause the fruit to shrivel. In situations where the average daily temperature is not low at this time of year, and where there is considerable fluctuation between the day and night temperatures, fruit intended for long storage should be placed in a cool store. It is advisable to repack stored fruit before placing it on the market.

DRAINAGE.

The drainage of heavy retentive soils should not be neglected. Tile drains, though more expensive, give the best results, and are the more convenient and permanent type of drain for the orchard. Existing open drains should be cleaned out and put in order, and the outlets to pipe drains cleared so as to let the drainage water pass freely away.

PREPARATION FOR PLANTING.

Where planting is intended this season the land, if not already cultivated, should now be thoroughly worked up and made ready. Good, deep working is required, and no effort should be spared to put the soil in good order before the trees are planted. After the trees are planted the land cannot be worked to the same advantage as now. Opinions differ in respect to the most favourable time to plant out trees. Some growers prefer the autumn, while others favour spring

planting. In general, autumn planting is suitable for dry, warm soils when properly matured trees are available, whereas in cold soils it is not advisable to plant the trees until spring.

SHELTER.

In exposed situations it is important that windbreaks should be planted to protect the trees from cold and heavy winds from the time they are set out. It frequently happens that no provision is made for providing shelter for the young trees, and as a result in subsequent years many trees and their fruits suffer badly. While shelter is important, it should not be overdone; it should be open enough to let the air through, but at the same time effectively break the wind. Shelter-trees should be planted a reasonable distance from the fruit-trees which it is intended they should shelter.

ORCHARD SANITATION.

Sanitation as applied to the orchard includes such practices as cultivation, pruning, control of pests and diseases, drainage, &c. The period between the completion of fruit harvest and the commencement of the winter work should be devoted to a thorough clean-up of the orchard and its surroundings. All fruit-cases should, where necessary, be repaired and stored away in a dry place for next season's use. The props used in supporting the fruit-laden branches should be gathered up and placed in a convenient place. Live fences should be trimmed, and where necessary the trees in the shelter-belts topped to keep them within bounds. Remnants of crops, prunings, diseased and decaying fruit, and all rubbish should be destroyed. Cleanliness in the orchard is essential.

PLOUGHING.

The orchard should be ploughed as early as possible after the fruit crop is gathered, so that the work may be completed before the land becomes too wet. In circumstances, however, where a green crop has been sown and has not reached a sufficient height it would be as well to delay the ploughing for a while in order to obtain the benefit of any additional growth the crop may make during the late autumn and early winter. The soil is greatly benefited by being exposed to the winter frosts and rains. To facilitate the surface drainage the land should be ploughed with the fall and not across the slopes. Plough to the trees, leaving an open furrow along the middle of the lands between the rows.

—W. K. Dallas, Orchard Instructor, Dunedin.

Citrus-culture.

The maintenance of a citrus-grove in good order and continued profit is a much more difficult proposition than the establishment of young citrus-trees. Planting is usually done in the spring, and the climatic conditions from then on up to late autumn are generally ideal for the growth of the citrus-plant—warmth, equable conditions, with periodic rain. But for permanent maintenance trees have to be fostered, and in some localities even coaxed, through periods of the year when climatic and other conditions are far from natural to citrus-growth. With the advent of such unfavourable periods it is well to consider

some of the main detrimental conditions with a view of ensuring against undue damage from them.

Surplus moisture: This is annually responsible for more serious setbacks to trees, or even total loss, than possibly any other cause. All the citrus tribe delight in warm soil-conditions, as evidenced by their habit of surface rooting. Allowing the land to remain waterlogged to saturation-point can only result in unfunctioning, if not decaying, roots, and if the tree is not lost it receives such a check as to take more than normal time to recover in the spring. Citrus-culture is most successful in parts of the world where water contents of the soil are regulated by irrigation. While we cannot regulate the amount of rainfall, there are several cultural points which, strictly observed, will minimize undue water content of the soil. Drainage is, of course, most necessary, and should be attended to even before the trees are planted, but it is quite possible that consolidation of the land has to some extent nullified the effect of what was once thought to be ample underdrainage. It is therefore well to ascertain whether sufficient drains have been made, and whether they are properly clean and in good working-order. If not, this should be corrected; otherwise the success of the whole system is menaced. Surface water can be quite as damaging as a waterlogged subsoil. Early winter regulation of the land-surface should therefore be so done as to avoid hollows, and the land between the trees left with a double open furrow to take away surplus surface water.

Shelter: The very nature of citrus-trees predisposes them to damage from exposure, broken branches or limbs, partial defoliation, a general hardening of the bark, and a loss of vitality. The main provision to minimize this is adequate shelter on the windward side. Where no shelter exists this should be remedied during early winter, so that shelter-trees or hedge-plants may be well established and ready to grow in early spring. Much existing shelter thought to be sufficient proves on examination to be deficient in so far as the ragged lower parts and gaps are concerned. This may be remedied by the erection of brushwood breakwinds if the position is unfavourable for the growth of interplanted hedge or shelter plants.

Frost: Much annual damage by frost is perfectly obvious, but the reduction of vigour and retardment of development are also considerable though not so noticeable. Most damage is done to young growth and at a variable minimum distance from ground-level, so that in areas subject to light frosts the trees grow beyond apparent damage in a few years; but in these first years all possible protection should be given. Adult trees also often suffer, mainly by injury to young growth, particularly that made during the previous autumn. Proper spacing of branches and laterals, and the avoidance of highly nitrogenous manures during late summer, will permit the wood to mature to a greater degree of frost-resistance.

Cleaning up: Owing to collar-rot and the amount of decayed bark caused through fresh manures or decaying litter being piled up round the boles of the trees, it is wise at this season to thoroughly clean up round the trunks. A mulch of general litter or manure may be very desirable during summer, but is more often injurious during winter.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

THE PROSPECTIVE BREEDING-BIRDS.

Now that the work of culling unprofitable stock has been carried out, the best hens selected and carefully marked for future breeding purposes, and the pullets settled down in their winter quarters, the poultry-keeper may look forward to an easier time during the next few weeks. There are, however, several matters which require attention if the plant is to be maintained at a high standard of efficiency.

In the first place, particular attention should be directed to the feeding of the prospective breeding-hens. They should be well fed but not overfed; on no account should the birds be allowed to become in an overfat condition during the moulting-period, or just before being called upon to lay eggs for hatching purposes. This is important, for it is well known that eggs containing strong germs, and chickens which are easy to rear, cannot be produced from an overfat hen. From now on the birds should be frequently handled, and if there is a tendency for them to put on surplus fat the ration should be slightly reduced; they should also be encouraged to exercise as much as possible, so as to prevent the storing-up of body-fat.

Another important matter that should be attended to now is the final selection of cockerels for next season's breeding-pens. In this important work it must be always remembered that constitution is the first requirement if a male is to prove a high-class sire. A specimen may exhibit good type, size, breed points, &c., and have an outstanding pedigree of performance behind it, but if there is the slightest evidence of a weak constitution the bird should be rejected. While constitutional vigour should be given first consideration, the question of breed type, standard weight requirements, and a knowledge of the bird's ancestors from an egg-producing standpoint must be also taken into consideration. After the birds have been carefully selected, male birds carrying large combs and long wattles, which are frequently seen in the lighter breeds such as Leghorns and Minorcas, should have these removed. As a result of this slight operation a bird will usually feed better and produce a greater number of fertile eggs and strong chicks. The operation can be simply performed with a pair of sharp scissors. In order to prevent bleeding a good dressing of fuller's earth should be applied to the cut part.

Where possible the breeding-birds should be provided with a good range—that great essential for building up bodily vigour.

SURPLUS COCKERELS.

The importance of marketing at once all surplus cockerels that are about five months old cannot be emphasized too strongly. It is never a wise policy to keep a cockerel beyond that age, for if not marketed then it will be weeks and even months before the bird can be brought to prime condition, and then, although heavier than at the prime-chicken stage, the return will not be as profitable. Once the chicken stage has passed, the consumption of food is increased, this being caused by the greater growth of plumage, bone, &c., necessary for the development of an adult bird. Obviously this process must be completed

before the matured adult stage can be attained. This will be readily understood when it is considered what a drain there must be on the bird's system in producing the thousands of adult feathers that nature demands.

This, however, is not the only drawback, for even if a fully developed cockerel is marketed in absolutely prime condition it does not appeal to the poulterer, to whom it is known as a "stag." The fact of it having a well-grown spur, sharp at the point, reduces its value as a table bird. Generally such a bird is coarse and larger than is generally desired for the high-class trade—in fact, it is usually classed on a par with an old hen, or, in other words, as a boiling-fowl. It is the flesh of the prime five-month-old bird that is most sought for the high-class trade and commands the highest value. Most poulterers are prepared to buy cockerels by the pound if they are offered at a young age and in prime condition. Thus the aim of the poultry-keeper should be to produce a maximum weight in a minimum period of time. This means that the birds must be well fed and managed from the time they are hatched to the day they are marketed. It costs much less to produce a pound of flesh than a pound of frame. In short, it will pay the farmer to prime his poultry just as it pays to prime other classes of live-stock.

CROP-BINDING.

This condition may occur from different causes, but it is usually due to the birds eating long fibrous grass, &c., the material rolling together and becoming a tangled mass which will not leave the crop. Lawn clippings are often responsible for crop-binding. It is true that when these are short and cut in a succulent stage they make an ideal green food for fowls. Where the danger lies is in feeding the clippings when they are long and in a fibrous condition. In this way the bird has no option but to swallow them whole, and often with ill effects. Crop-binding is rarely seen where the birds are provided with a free range, as then they are not only able to select the most succulent pieces of grass, but in addition are enabled to pick it off to a length that will not be injurious.

Another common cause of crop-binding is when grass hay is used as litter for the birds to scratch in, especially where the floor of the house is damp, or where the hay becomes damp or wet from any cause. This has the effect of bringing the hay back to a more or less natural state, with the result that the birds are induced to eat it. Where ample green food is provided the birds will be less inclined to eat the hay. Grass hay cannot be looked upon as a good scratching-material unless it is frequently renewed and maintained in a dry state. As with most poultry troubles, the best way of dealing with crop-binding is to prevent it. Long grass and similar substances should not be supplied to fowls of any age without being finely chaffed. By way of further precaution the birds should have an ample supply of sharp gravel grit before them at all times.

For curing crop-binding—when the bird is worth the trouble—the crop may be opened with a sharp knife. The outer skin should be first cut and drawn downwards, and an incision made into the crop itself large enough for inserting the finger and drawing the fibrous substance away. The crop should then be stitched separately with silk, and the outer skin afterwards. Feed on soft food for a few days, and withhold

water for at least a day. Unless the bird is a valuable one it is not worth going to this trouble, as the ailment is likely to recur.

SOFT OR DISTENDED CROP.

In this condition the food and water remain in the crop and fail to enter the digestive tract. The cause of the trouble is usually a clog in the tract. For treatment kneel down and hold the bird between the knees. Open the mouth with the left hand, stretch the neck upwards, and pour water heated to blood temperature slowly down the throat until the crop is filled. Then gently knead the crop until the mass is softened. Then turn the bird head downwards, and at the same time knead the crop with the fingers, which will assist the bird to vomit. If the operation is not successful it may be repeated. The bird should be given a dose of Epsom salts (about the tenth part of a packet dissolved in water) and allowed to fast for at least a day. Also make sure that the patient, as well as the whole of the flock, is supplied with plenty of sharp grit.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

MARKETING THE CROP.

At the close of the season the beekeeper should give his undivided attention to marketing his crop. It usually happens that a good season causes something akin to a panic among a large proportion of the producers, and as a result they are too anxious to dispose of their crop, at anything but remunerative prices. The increased cost of working-equipment, packages, &c., has become a serious burden on the profits of the apiary, and at the present moment there is every indication that the cost of packages to the producer will be increased. Apart from the cost of equipment, very few beekeepers take into consideration the amount of labour and time requisite to produce a crop; and, if beekeeping is to be made to pay, these factors must not be lost sight of. Where bees are run as a side-line very rarely do we find the item of labour charged against the crop, and as a result it is sold at a low figure.

There are far too many jobbers in the honey trade. Their operations act against the legitimate producer and tend to unbalance the market. Too often the beekeeper is led away by their talk of overproduction and lack of demand for his commodity, and he is anxious to dispose of his crop before his fellow-producers can dispose of theirs. A brighter, better, and more businesslike way of dealing would be for beekeepers in every case to meet together and agree upon prices. By organized effort the price of honey can be reasonably raised and its value as an article of food placed before consumers. It is pleasing to note that the principle of co-operation is being steadily extended among honey-producers, and that the operations of the Honey Producers' Association, which was formed for the purpose of jointly handling the product of the individual, is leading to larger sales, with more uniform and better prices. The building-up of a payable local market depends largely on

the disposal of the surplus crop, and this can only be accomplished by an organized scheme of export. The efforts of the industry to arrange such a scheme have already been the means of increasing the local market value of honey.

With respect to the local market, until such time as the producers are combined for the purpose of establishing bottling-depots in every centre the beekeeper must not relax his efforts in preparing his crop for market, more especially if increased consumption and higher values are the objective. In the absence of co-operative bottling-depots too many beekeepers make the mistake of forwarding their honey in bulk lots, to be afterwards retailed under a name which is not that of the producer, and usually not even that of his agent. It is far better for the beekeeper to attend to his own bottling than to allow his honey to be disposed of haphazard by any one into whose hands it may fall. While honey is in a liquid form it is little trouble to fill 1 lb. or 2 lb. packages, stamped with the producer's own name and trade-mark, and in a year or two he will find that his product will need no advertisement. Quality and care tell in the long-run. Looking at our markets to-day, we find the crop is moved off as quickly as possible, and no general effort is made to supply honey at all seasons of the year.

The value of attractive packages should weigh with the producer, whether the honey is put up in bulk for the merchant or in small packages direct for the retail trade. In order to appeal to the consumer the packages containing honey must be made as attractive as possible, and every care observed in its preparation as an article of food. An inspection of lines sent forward to market will serve to demonstrate the advantage of careful preparation. Consignments forwarded in good, clean cases, carefully graded, and contained in new tins readily command attention; whereas lines which have been packed in rusty tins and present a rather unattractive appearance generally are hard to dispose of. Too often merchants are compelled to sell them at a reduced rate, although the quality of the honey is quite on a par with that packed in new packages. In such cases the producer is apt to blame the merchant for a reduction in price, but as a rule the fault lies with himself.

—E. A. Earp, Senior Apiary Instructor.

HORTICULTURE.

REFITTING AFTER THE BUSY SEASON.

If there is such a thing as an interval in the horticultural calendar it is now, although the term has only a relative meaning in such a climate as we enjoy, which generally permits the operations of sowing and reaping the whole year through. The present is a suitable time to refit, and make such repairs to gates, roads, sheds, &c., as may be required. Shelter plantations and hedges also may receive attention. Too often these valuable improvements, upon which so much depends, are roughly trimmed with an axe — and at out-of-season periods at that. The result is not only great disfigurement, but dead stumps and branches in the trees and on the ground are the most suitable means for breeding diseases and pests of many kinds, and is sure in a very short time to defeat the purpose for which the trees were planted.

Where it is necessary to cut into old timber of any size it should be removed by a clean saw-cut close up to the main limb from which it originates, previously making a slight undercut a few inches along the branch to be severed, so that when it falls away the bark is not ripped from the main limb from which it has been removed. In this way wounds heal as quickly as possible, without any decay setting in to endanger the life of the tree. Such trimmings need to be dealt with promptly by removing them into an open space, cording the heavier portions for firewood, and burning up the smaller twigs and branches on the spot if there is no other use for them. In this way only may the plantations be kept effective for a long period, and the danger from disease and fire be reduced to a minimum.

Young hedges of most kinds require to be cut hard back for two or three seasons to make them thicken and stool at the base. It is very desirable that this should be done, and the work may be undertaken now. Not only does a properly grown hedge look better, but a strong base is one of its most important requirements.

Metalling gateways and cleaning up open drains and water-tables is seasonable routine work which if done now keeps the land drained during the colder wet weather, and brings it into early condition for planting in the spring-time.

STERILIZING THE SOIL.

In these days when repeated pure cultures are grown by fruitgrowers and market-gardeners it is not surprising that the land becomes "sick," as far as these special crops are concerned. Glasshouses devoted to tomato-culture year after year, often with no alternating green cover-crop between the seasons, are a typical case in point. The trouble is often intensified by the fact that many of the diseases affecting the land and plants are seed-borne.

As before pointed out, rotation cropping is the best and cheapest method of dealing with these troubles, but in many instances it pays to go to the expense of sterilizing the land to bring it into condition. For doing this successfully there is doubtless much more to be learnt than is known at present, but the experience of every season is of value. Steam is still regarded as the most effective means of sterilizing the soil, and for glasshouse work of any extent it is doubtless the best. The first cost may be considerable, but with care the outfit will last for many years. There is also a possibility of using the plant for heating purposes in the glasshouse in the ordinary way, which, with the ordinary materials for the hotbed becoming scarcer every season, would be a great convenience. For soils infected with fungus troubles the formalin treatment has given good results, while for soils in which eelworm or other insect pests are located treatment with carbon bisulphide has been beneficial when administered when the land was bare.

CLEANING UP THE GLASSHOUSE.

Where glasshouses have not been cleaned up yet this season they should receive careful consideration now. The good, clean crops usually grown in new houses are largely due not merely to the new land but also to the clean condition of the house. Where there is any area of concrete or brick work a coating of hot limewash should be applied; in

this it is usual to include a little bluestone solution, or flowers of sulphur, or kerosene. A little cement also mixed in will thicken the mixture and give good adhesion.

EARLY SPRING PEAS.

In the warmer localities a crop of peas sown now may be harvested in early spring, and is often a very profitable crop. A good strain of the Stratagem variety is generally used for this purpose. It is generally advisable to give plenty of room between the rows for this crop, and they should run in a north-and-south direction. If the seeds are soaked for twenty minutes in kerosene it will protect them from vermin ; and as soon as the plants are through the ground a suitable dust or spray will further protect them from attack. A spray of bordeaux mixture will protect them from slugs, and probably from birds also.

IN THE TOBACCO-BARN.

Cured tobacco-leaf will now require careful attention, particularly where it is stored in buildings that are open to the atmosphere. Low temperatures and humid conditions quickly set up moulds that render the leaf valueless. Small charcoal fires about the floor of the shed are sometimes lit to counteract such conditions. In any case the sooner the leaf is stripped from the stalks now the better. For this purpose humid conditions are necessary for making the leaf pliable, so that it may be handled without breaking. This may be done by admitting a humid atmosphere at night, or it may be necessary to damp down the floor to create the necessary conditions. The best method, and one used in large establishments, is to have a chamber into which steam is admitted when the tobacco is in position ; the conditioning then is rapid, and less likely to be accompanied by the development of fungus troubles. As the leaves are taken from the stalk they are graded for colour and condition. They are then bound together by the stems with a leaf, about twelve to a bundle, or, as it is usually termed, a "hand." The hands may be placed back on the curing-sticks for further drying, if necessary, or they may be bulked for a mild fermentation, or baled for market. For the latter purpose about 12 to 15 per cent. of moisture is required.

—*W. C. Hyde, Horticulturist.*

Noxious-weeds Orders.—The Dannevirke County Council has declared foxglove to be a noxious weed within the district under its jurisdiction. Similarly, toad flax (*Linaria vulgaris*) has been declared by the Mount Hutt Road Board and gorse by the Greymouth Borough Council as regards their respective territories. The Waitaki County Council has declared Californian thistle *not* to be a noxious weed within that county.

Drinking-holes for Stock.—Losses of stock sometimes occur through unformed drinking-holes in open drains. Cattle after drinking are apt to wander up the drain and become bogged, and are often lost. This wandering up the drains is principally due to fouling of the water at the drinking-hole by the stock treading up the mud. In making a drinking-hole in an open drain the slope dug should be cut deep at the drain end, so as to form a narrow bay. A large log should be placed at the bottom of the slope, and the drinking-place fenced from the drain by a strong rail fence. It is also a good plan to line the bottom of the drinking-hole with stones.

THE NEW DAIRY-PRODUCE REGULATIONS.

MANUFACTURE AND EXPORT.

(Concluded from March.)

Condemned Dairy-produce.

80. In every case where dairy-produce is condemned by an Inspector—(*a*) The Inspector shall as soon as practicable notify the owner of the produce that it has been condemned; and (*b*) the Inspector shall, at the expense in all things of the owner, cause such produce to be removed to some convenient place and there so treated as to become absolutely unfit for human consumption. (*c*) The owner shall as far as required by the Inspector assist him in carrying out the provisions of this clause, and for that purpose shall do whatever the Inspector directs. (*d*) The net proceeds realized for such produce shall be payable to the owners.

Weighing, Sampling, Testing, and Recording at Manufacturing Dairies.

81. (1.) Clauses 82 to 101 hereof, both inclusive, shall apply only to dairy factories whose owners purchase milk or cream, to be paid for wholly or partially according to the percentage of butterfat contained therein, for the manufacture of butter or cheese, and only to milk or cream so purchased.

(2.) In the same clauses the word "owner" means exclusively any owner (as defined in the said Act) of a dairy-factory who purchases milk or cream as aforesaid.

82. Every owner upon weighing any cream delivered to his dairy factory shall, where the weight is an exact number of half-pounds, record the weight accordingly, and where the weight is not an exact number of half-pounds record it at or above the nearest half-pound below the exact weight; and if any such cream is weighed in a container shall, where the weight of the container is an exact number of half-pounds, compute the tare accordingly, and where the weight of the container is not an exact number of half-pounds compute the tare at or below the nearest half-pound above the exact weight of the container.

83. Every owner shall secure, for the purpose of testing, a truly representative sample of each delivery of milk or cream made to the dairy factory. The quantity of each sample shall be sufficient to enable a test to be made as hereinafter provided and to leave a portion sufficient for retesting.

84. The owner shall—(*a*) Take such sample separately from each can or weighing, and compute the weight of butterfat in the can or weighing from the test made by him of the sample and the weight of the milk or cream in the can or weighing; or (*b*) make a composite sample of each supplier's milk or cream for each day or other suitable period by taking samples from each can or weighing in proportion to the total weight of milk or cream represented by each sample, and compute the weight of butterfat from the test made by him of such composite sample and the weight of milk or cream in all the cans or weighings represented by the composite sample.

85. The owner shall keep each such separate or composite sample in a cool place, and in a tightly stoppered glass bottle plainly labelled with the supplier's name or number.

86. The owner shall not add, or suffer to be added, to any such sample any extraneous matter save necessary preservative in a powder or tablet form.

87. Every such sample shall be tested on the customary testing-days (which, excepting during the months of June, July, and August, shall be at intervals not exceeding twelve days) by the owner or by an agent appointed in writing by him for that purpose, and in either case the tester shall be a person competent in the work of testing by the prescribed method in use at the dairy factory.

88. As soon as practicable after the testing is completed the tester shall make with ink or indelible pencil an accurate record showing the name or number of each supplier whose milk or cream was tested, and opposite thereto the percentage, by weight, of butterfat as ascertained by testing the sample. He shall also date and sign the record, and file it at the dairy factory or at the owner's office. The owner shall retain all such records for at least eighteen months after the close of the dairy factory's financial year, and shall keep them open to examination at reasonable hours by any Inspector, or by any supplier, but only with respect to any milk or cream sold by such supplier.

89. (1.) In the case of separate samples as provided for in subparagraph (*a*) of clause 84 the owner shall keep unchanged, until three o'clock in the afternoon of the day on which the tests were made, or, in the case of tests made after three o'clock in the afternoon, until noon of the following day (as the case may be), in tightly stoppered glass bottles, each plainly labelled with the supplier's name or number, the portion of the original sample not abstracted in testing.

(2.) On any day the owner shall, should an Inspector so direct, retain half, by number, of the samples of the previous day's testing, but not necessarily more than fifty, until three o'clock in the afternoon. The Inspector may specify individually the samples to be so retained, and, if the Inspector does so specify, the owner shall retain the samples specified by the Inspector.

90. In the case of composite samples made as provided for in subparagraph (*b*) of clause 84 the owner shall in like manner, and irrespective of an Inspector's direction, keep the portion of each sample not abstracted in testing for four clear days following the day on which such samples were tested: provided that samples need not be retained beyond the end of the part-monthly testing-period following that in which they were taken.

91. (1.) The owner or tester shall not use any pipette in testing milk, or any Babcock or Gerber test-bottle for milk or cream, unless such pipette or bottle is of an approved pattern and has been tested and marked by an authorized officer of the Department of Agriculture.

(2.) Such authorized officer shall destroy any pipette or bottle which, on being tested by him, is found to be, in his opinion, insufficiently accurate for use in testing milk or cream, and no compensation shall be payable by the Department of Agriculture in respect of such destruction.

(3.) Any person who submits any dairy glassware to an authorized officer for testing shall on demand pay to the Department of Agriculture fees as follows: Milk or cream bottles, 2d. each; skim-milk bottles, 1s. each; pipettes, 3d. each; and thermometers, 1s. each: plus postage in every case.

92. The owner or tester shall not use any appliance for weighing samples of cream for testing unless such appliance is of a type approved by an Inspector and in good working-order. Every weighing-appliance used in testing shall be sensitive to 0·05 grams (metric).

93. In testing samples of cream the amount put into the test-bottle shall be 9 grams or 18 grams in the case of the Babcock test, and 5 grams in the case of the Gerber test, and the correctness of the amount shall be ascertained by actual weighing.

94. (1.) In testing milk the percentage of butterfat as read from the Babcock test-bottle shall include the whole of the fat from the bottom of the column to the highest point of the meniscus.

(2.) Fat-saturated alcohol, or oil of a lower specific gravity than that of butterfat, shall in testing cream by the Babcock method be used for levelling the meniscus of the butterfat column in the test-bottle, and the reading shall be taken from the bottom of the column of fat to the point of junction between the fat and the levelling-fluid.

95. The owner, or an agent or agents appointed in writing by him for that purpose, shall on each day on which butter is made in the dairy factory make an accurate record in ink or indelible pencil of the weight of butter made on that day, showing separately the weight packed in bulk and in pats, also of the weight of such butters delivered by the dairy factory on that day. The owner or such agent shall sign and date each day's record, and file it at the dairy factory or the owner's office, and the owner shall keep it there for at least eighteen months after the close of the financial year to which it relates.

96. The owner shall make, and file at the dairy factory or his office for at least eighteen months after the close of the financial year to which it relates, an accurate record daily, as near as may be, of the following particulars: (*a*) The weight in pounds, and the butterfat percentage by weight, of all milk or cream received from each supplier; (*b*) the weight in pounds of butter credited to each supplier for each test, and for each month or other period of payment; (*c*) the number of pounds of butterfat purchased in any form from persons other than suppliers and used in the manufacture of butter or cheese, or sold as milk or cream or otherwise disposed of; (*d*) the weight of butter purchased or received from other dairy factories or otherwise; and (*e*) the weight of all butter disposed of, whether manufactured or purchased.

97. The owner shall, at or prior to the time of each payment made or account rendered in respect of milk or cream to any of his suppliers, furnish such supplier with a statement of the weight and test of his milk or cream, and the number of pounds of butterfat computed therefrom, for each testing-period covered by the payment or account; or, when payment is based on the weight and test of each can or single delivery, with a detailed statement of the weights, tests, and pounds of butterfat of the several lots being paid or accounted for.

98. Any person who falsifies any record of a kind referred to in clauses 82 to 97 inclusive of these regulations; over-reads or under-reads any milk or cream weighing, or any Babcock, Gerber, or other test; fails to comply with the requirements hereinbefore prescribed in conducting any test; or in any other way makes any incorrect determination of butterfat, commits a breach of these regulations.

Check upon Sampling, Weighing, Testing, and Recording.

99. An Inspector may at any reasonable time do any of the following things at or in connection with any dairy factory: (*a.*) Take without payment such quantities as may reasonably be required as samples of any lot of milk or cream or milk-products whersoever found, and may weigh and test such samples. (*b.*) Examine and test any samples of milk or cream kept in accordance with clauses 89 and 90 hereof for retesting. (*c.*) Examine the records of receipts of milk, cream, butterfat, butter, or cheese; of all Babcock, Gerber, or other tests made; of the weight of all butter or cheese or other dairy products manufactured daily; and of the weight of butterfat for which any supplier has been credited or paid.

100. The Inspector shall relock or reseal any container which has been unlocked or unsealed by him for the purposes of the last preceding clause.

Investigation of Owner's Annual Statement to Suppliers.

101. (1.) Every application to the Minister under section 5 of the Dairy Industry Amendment Act, 1922, for an investigation into the correctness of an owner's certified annual statement to his suppliers shall be made in the form No. 25 in the Schedule hereto.

(2.) The approved security to be lodged under the provisions of the last-mentioned section may be given by way of bond for such amount as the Minister may in each case determine.

Exhibiting Acts and Regulations.

102. Every owner of a manufacturing dairy shall place and keep in each such dairy, in a conspicuous place accessible to any supplier of the dairy, a copy of the Dairy Industry Amendment Act, 1922, and of these regulations.

Duties and Penalties.[1]

103. Where a duty is directly or by implication imposed by these regulations and it is not specified in the said regulations by whom it shall be performed, the owner concerned shall at all times be responsible for its due observance or performance.

104. Any owner of a dairy factory, or any purchaser, seller, or collector of milk, cream, or dairy-factory products, or any carrier or storage-owner dealing with milk, cream, or such products, who refuses admission to, or hinders, any Inspector in the exercise of his duty, or who refuses or neglects to render such reasonable assistance as may be required by an Inspector in that respect, commits a breach of these regulations.

105. Any person who (*a*) fails to observe or perform any duty directly or by implication placed upon him by these regulations; (*b*) does anything contrary to the provisions thereof; (*c*) not being an officer in the exercise of his duty alters or obliterates, or causes to be altered or obliterated, any owner's brand, any grade-mark, or any record or document made or used in pursuance of these regulations; (*d*) counterfeits any such brand, grade-mark, record, or document; (*e*) empties, or partially empties, or otherwise interferes with, the contents of any package or thing marked in pursuance of these regulations in order to put therein or substitute therefor any other contents; or (*f*) improperly uses any previously marked package or thing for the purpose of representing or implying that the marks thereon are valid, commits a breach of these regulations.

106. Any person who commits any breach of these regulations in respect of which no penalty is provided elsewhere is liable to a penalty of £50.

107. Nothing contained in these regulations shall impose any liability upon the owner of a supplying dairy who is not the occupier thereof, where the supplying dairy is in the occupation of any other person by virtue of a tenancy created prior to the coming into operation of these regulations; but this exemption shall not affect the contractual rights and liabilities to each other of the owner and occupier of any such supplying dairy.

WEATHER RECORDS: MARCH, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

MARCH is regarded as the first month of autumn in these latitudes, but the earlier half was decidedly summerlike—calm, warm, and fair generally; the latter part of the month was, however, quite different in character—cold, unsettled, and boisterous. The contrast between the two periods was very marked; an observer in Otago found the average temperature of the first half ten degrees higher than that of the latter.

The trough of one westerly "low" passed on the 16th, and was soon succeeded by a more violent and extensive disturbance of a similar type. The lowest reading of the barometer, 28·95 in., was recorded at 3 p.m. on the 20th, at the Bluff; and this storm was apparently affiliated to a cyclonic disturbance the centre of which passed over the South Island, the lowest atmospheric pressure (28·65 in.) being observed at Christchurch at 7 p.m. on the 23rd. These storms will be remembered by being associated with the close of the Royal visit.

Although popularly described and recognized as "equinoctial"—and not without some justification, for there have been in past years several notable storms about the time of the Equinox, the greatest one, in 1918, causing the Raetihi bush-fire—there is no apparent scientific reason for associating these disturbances with the solar crossing of the Equator, and their concurrence must still be regarded as fortuitous.

The 28th witnessed the passage of the trough of another westerly or antarctic "low," after which the barometer rose steadily with strong southerly winds, bringing a cold snap at the close of the month. There were some slight frosts, and snow was left rather low down on the southern mountains.

With the exception of the east coasts of both Islands, rainfall was generally much above the average—it was, indeed, excessive on the higher levels and southernmost parts of the South Island. The total fall for the month at Arthur's Pass was 36·42 in., of which 10·35 in. fell on the 23rd, and of this 8·52 in. was registered in nine hours. Floods were reported in the Waimakariri and other rivers on this account, and there was also a big flood in Marlborough at this time.

The westerly gales were troublesome to orchardists, for apples, in particular, had not quite matured. The heat and dryness of the summer, however, left a warm soil on which the rains produced a profuse and wonderful growth of autumn pasturage.

RAINFALL FOR MARCH, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	4·18	9	1·22	3·58
Russell	3·43	8	1·21	3·35
Whangarei	2·87	13	0·88	4·81
Auckland	4·57	15	0·62	3·03
Hamilton	7·54	17	1·84	3·88

RAINFALL FOR MARCH, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
North Island—continued.				
	Inches.		Inches.	Inches.
Kawhia	6·84	15	1·74	3·12
New Plymouth	6·40	17	1·22	3·62
Riversdale, Inglewood ..	12·71	16	2·08	7·39
Whangamomona	9·53	19	2·34	5·46
Tairua	5·80	11	1·70	6·73
Tauranga	5·10	11	2·06	4·16
Maraehako Station, Opotiki ..	7·26	12	1·64	4·09
Gisborne	2·59	11	0·66	4·51
Taupo	4·22	9	0·98	3·53
Napier	1·08	7	0·50	3·29
Maraekakaho Station, Hastings ..	1·85	10	1·03	3·10
Taihape	3·31	14	0·87	2·95
Masterton	2·72	9	1·51	3·15
Patea	5·31	16	1·72	3·60
Wanganui	3·63	8	1·33	2·62
Foxton	3·38	7	2·00	2·20
Wellington	3·39	12	1·15	3·29
South Island.				
Westport	7·04	18	1·32	5·80
Greymouth	12·30	20	2·16	9·12
Hokitika	15·56	20	4·20	9·70
Ross	19·65	16	2·60	10·35
Arthur's Pass	36·42	17	10·35	9·74
Okuru, Westland	20·52	20	4·13	15·48
Collingwood	8·04	15	1·91	4·19
Nelson	2·21	10	1·10	3·08
Spring Creek, Blenheim	1·95	5	0·91	1·81
Tophouse	8·09	18	2·43	4·33
Hanmer Springs	5·24	16	2·13	2·92
Highfield, Waiau	2·52	8	0·76	3·00
Gore Bay	1·80	7	0·56	2·29
Christchurch	1·15	11	0·36	2·05
Timaru	1·52	15	0·74	2·31
Lambrook Station, Fairlie ..	2·04	11	1·62	2·58
Benmore Station, Clearburn ..	4·54	14	1·70	2·64
Oamaru	1·56	9	0·39	1·73
Queenstown	6·75	13	1·59	2·63
Clyde	3·70	11	1·50	1·50
Dunedin	5·06	17	2·18	2·98
Wendon	5·34	19	1·13	2·93
Gore	4·97	19	1·07	3·47
Invercargill	8·65	21	1·31	3·90
Puysegur Point	11·82	19	2·04	8·00

—*D. C. Bates, Director.*

SEED-TESTING CHARGES.

THE charges made by the Seed-testing Station of the Department of Agriculture on commercial samples have been reduced to 1s. per sample for either germination or purity test, and 2s. for combined germination and purity test. These are half the amounts previously charged. The revised scale came into force from 1st April —the beginning of the new financial year.

EMPIRE MARKETING BOARD POSTERS DISPLAYED IN WHITEHALL, LONDON.

VETERINARY SURGEONS BOARD.

APPOINTMENTS have been made to the Veterinary Surgeons Board constituted under the Veterinary Surgeons Act, 1926, as follows: Registrar, C. J. Reakes, D.V.Sc., M.R.C.V.S., Director-General, Department of Agriculture, Wellington, who is also chairman; A. M. Brodie, M.R.C.V.S., Hastings; H. S. S. Kyle, M.P., G.M.V.C., Christchurch; W. C. Barry, M.R.C.V.S., District Superintendent, Department of Agriculture, Wellington.

Dr. Reakes was appointed by the Governor-General from among the veterinary surgeons in the employment of the Department of Agriculture, Mr. Brodie on the recommendation of the Minister of Agriculture, and Messrs Kyle and Barry on the recommendation of the New Zealand Veterinary Association (Inc.).

Members (with the exception of the Registrar) will hold office for three years, with the right of reappointment.

Regulations under the Act, governing registration, were published in the *Gazette* of 17th March, 1927. The full text of the Act was printed in the *Journal* for November last.

EMPIRE MARKETING BOARD POSTERS IN BRITAIN.

THE photograph reproduced on the opposite page, taken recently in Whitehall, London, shows some effective posters set up by the Empire Marketing Board. The poster on the right is a New Zealand dairying scene (showing delivery of milk to a Taranaki cheese-factory). "Ships in the Channel" is the subject of the centre poster, and on the left is a Canadian harvest scene. Mr. F. C. Herrick painted the New Zealand and Canadian pictures, and Mr. Norman Wilson, R.I., the centre piece. This set of posters is being displayed all over London and in the largest cities of Britain, in specially favourable positions.

The text of the letterpress displayed to the left of the New Zealand poster reads as follows:—

THE DAIRIES OF NEW ZEALAND.

WHENCE CAME THE HERDS? Just over a hundred years ago the first cattle were shipped to New Zealand. The great dairy herds of New Zealand have been bred from stock bought from the farmers of Britain. To-day in New Zealand, every night and every morning, a million cows are milked. *The herds went from Home.*

WHENCE CAME THE MEN? The men and women that built up the great dairy industry of New Zealand were Englishmen and Scotsmen, Welshmen, and Irishmen. They are proud of their race. *The men went from Home.*

Every year you eat £17,000,000 worth of New Zealand butter and cheese. Every year New Zealand buys from you £24,000,000 worth of the goods you make. So each country helps the other.

EMPIRE BUYERS ARE EMPIRE BUILDERS.

WHEAT AND OATS THRESHING RETURNS.

RETURNS of actual threshings received by the Government Statistician up to 19th March from threshing-mill owners showed that until then totals of 1,146,394 bushels of wheat and 683,433 bushels of oats had been threshed out. The average yield per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 38·08 bushels for wheat and 43·26 bushels for oats. The figures for the Canterbury, Otago, and Southland Land Districts respectively were as follows: Canterbury—Wheat, 1,026,107 bushels threshed, averaging 38·60 bushels; oats, 535,179 bushels threshed, averaging 43·52 bushels. Otago—Wheat, 69,934 bushels, averaging 36·42 bushels; oats, 100,337 bushels, averaging 47·35 bushels. Southland — Wheat, none returned to date stated; oats, 2,856 bushels, averaging 75·16 bushels per acre.

REVIEW.

"PLANTS OF NEW ZEALAND," by LAING and BLACKWELL; 468 pp., with 175 illustrations; third edition; 15s. Whitcombe and Tombs, Ltd.

IT has come to be recognized more and more clearly of late years by those whose work is in any way dependent on the teachings of a science that of none of its branches can it be said, "This is no concern of mine; this can have no bearing on practical everyday affairs." This country still contains among its areas of immediate or potential agricultural value a great many that have on them enough of the original plant covering to serve as the most reliable of teachers—to offer advice that cannot be ignored by the man whose ambition is to make the very most of his land holdings.

The first step in making use of this advice is to know at least something of the language in which it is written—in other words, to have some idea of the names that have been given to plants by botanists. The use of such names as *Paspalum dilatatum* and *Poa pratensis* by all farmers who have anything to do with these grasses shows that there is no fundamental prejudice in this direction, and that it may be wiser to use names of general application all the world over, instead of mere local terms that quite likely are applied to totally different plants in another part of the country. It may be said that whoever is interested enough can quite easily name any plants he wants to; but while it is true that all the flowering-plants and ferns known at the time of its publication are fully and accurately described in Cheeseman's "Manual of the New Zealand Flora," this is a technical work requiring special training in the meaning of botanical terms, and it is not illustrated except for two supplementary volumes showing drawings of comparatively few of the plants.

The present work does not claim completeness—many plants that are of little importance are not described at all; but the illustrations, which consist of photographs, sometimes of parts such as the flowers and fruit, and sometimes of the whole plant as it appears when growing, are both numerous and clear, and to the layman are often more vividly descriptive than the best technical account could be. After all, the ability to know one plant from another is only one of many steps on the way to an understanding of that branch of botany which must have the greatest appeal of any to the enthusiastic farmer, which tells him what it is about one plant that makes it fail when all conditions seem favourable to its development, while another—with apparently similar equipment—is able to hold its own, and do very much more than hold its own, in the country it is occupying.

New Zealand may well be proud of her contributions to the literature of ecological botany, which is the science of the living plant in relation to its surroundings. Each of Dr. L. Cockayne's two books—"The Vegetation of New Zealand" and "New Zealand Plants and Their Story"—is a classic in its way. The author of the work under review (we learn from the preface that Mr. Laing is alone responsible for the preparation of the third edition), though he has made many original contributions to botany, would be the last to claim for "Plants of New Zealand" the name of a work of research in ecology. As he himself says in the introduction, "The attitude of botanists towards many problems has altered much since the original edition of the work, and it has been our endeavour to reflect that attitude in the pages of this book." Herein lies its strength, for it consists essentially in a summing-up of all that so far is known of the flora and the vegetation of New Zealand in ways that make it clear to the non-technical reader. In this most difficult task there is shown a remarkably level judgment—one that is by no means ready to accept a theory as fact merely on account of its novelty or ingenuity, but which at the same time is quick to see a discovery that is destined to leave its mark in the development of the science. A book of this type may well find a place on the farm book shelf.

E. H. A.

Peas for pigs should not be threshed but fed in the pod. The exercise in getting the peas out of the pods is good for the pigs, but, more important still, they cannot gorge themselves. Peas fed in this manner are properly chewed and masticated, whereas if threshed and fed whole a great many of the peas pass through the animal.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PARALYSIS IN PIGS.

G. B. B., Tolaga Bay :—

I am having a lot of trouble with my pigs, almost at any size or age from four weeks to five months. Quite a number go in the hind quarters and flop about; if they are not killed they pine away and die in about three weeks. They are fed on skim-milk, with maize occasionally. They have plenty of room to roam about, fresh water to drink, and rough grass to eat. I have tried shutting them up in sties with no better result. If you could advise a remedy I would be greatly obliged.

The Live-stock Division :—

The condition "paralysis" is a common one in young pigs throughout the Dominion, and in practically all cases can be attributed to the dieting on skim-milk. Cold and damp, also the presence of intestinal parasites, are regarded as contributing causes. A diet of which skim-milk is the sole or principal constituent is insufficient for a growing animal—lacking the ingredients necessary for body-building; therefore it should be supplemented with an allowance of pollard, linseed-meal, crushed oats, or grains, &c.

STORAGE OF APPLES ON THE FARM.

C. B. CLAPHAM, Feilding :—

Please advise me of the best way of storing apples (Sturmers) for winter use on the farm.

The Horticulture Division :—

To store Sturmer apples for winter use on a farm you are recommended to pick the fruit with the stem intact, and handle them with more than the usual care. Grade out the fruit that is perfectly sound, place it in boxes (benzine-cases are very suitable), and stack them in a cool, well-ventilated shed. Some 3 in. by 2 in. timber should be placed beneath the stacks to keep them off the ground, and 1 in. strips between each tier of boxes. Also an inch or so of space should be left, vertically, between the cases. In this way the fruit should keep, with little or no loss, till the middle or end of August. The damaged fruit that is graded out should be used up at once, and no attempt made to keep it for any time.

BORER IN LEMON-TREES.

F. REYNOLDS, Thornton, Bay of Plenty :—

I am concerned about the borer in my lemon-trees, ten years old. The affected trees have perhaps a teacupful of workings of the borer on the ground at the base of the trunk, and look as if they will die soon. Could you suggest a remedy?

The Horticulture Division :—

To keep lemon-trees free from borers they should be properly pruned, all weak and dead wood being also carefully removed. Spray and feed the trees well to keep them in good health, and they should be very little troubled with this pest, which chiefly attacks trees or parts that are in weak condition. The larvæ infecting limbs may be destroyed by injecting benzine into the holes and plugging them afterwards.

LAMPAS IN HORSE.

"FARMER," Onga Onga :—

We have a horse six years old which is very bad with lampas. Could you inform me of a cure ?

The Live-stock Division :—

Lampas is a natural condition occurring in horses during the development of the permanent incisor teeth, as, owing to these being short at first, the palate and gums become slightly inflamed and appear swollen. The condition passes off as the teeth grow longer, and no treatment is necessary beyond providing soft and chaffed food for the short time the mouth is sore.

SURFACE ROOTS OF SHELTER-TREES.

F. R. L., Eketahuna :—

Is it necessary to dig ditches along shelter-belts so as to force the roots of the trees deeper into the soil ? I have planted two shelter-belts of pines, and do not want the roots of the trees coming too far out into the paddock near the surface, because of ploughing later on.

The Horticulture Division :—

If the land is of fair quality, with a good subsoil, and the enclosing fences are about as far from the trees as the main limbs extend, there should be little trouble from surface roots. In the case of a light soil on shingle, the surface roots are generally extensive but necessary, and should be allowed to remain if a high shelter is required. Much depends on selecting the right kind of trees for the soil and purpose.

HARD-MILKING COW.

R. MORRISON, Dunedin :—

I have a cow which after calving is easy to milk in the first few weeks, and then gradually gets harder. Do you know of a remedy or preventive for this ?

The Live-stock Division :—

The causes of difficult milking are many and varied, and it would be extremely difficult to diagnose the trouble in the cow referred to without examination. Generally speaking, a cow which is difficult to milk is not worth keeping unless she is a pedigree animal. If the one in question is not of this class it might be advisable to fatten her off for the butcher.

FORTHCOMING WINTER SHOWS.

Whangarei A. and P. Society : Whangarei, 10th to 14th May.
Poverty Bay Winter Show Association : Gisborne, 11th to 14th May.
Waikato Winter Show Association : Hamilton, 31st May to 4th June.
Manawatu A. and P. Association : Palmerston North, 14th to 18th June.
South Taranaki Winter Show Company : Hawera, 29th June to 6th July.
Wellington Winter Show Association : Wellington, 15th to 30th July.

Secretaries are invited to supply dates of their shows for publication in this list.

New Zealand Wool Committee.—The Minister of Agriculture has appointed as members of this body Messrs. H. T. Milnes and L. B. Andreae.